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EXPLORATIONS IN CENTRAL BORNEO

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THE FAR INTERIOR of Central Borneo, third largest island in the world, was not penetrated by any white man until the present century, though Spenser St. John, starting from Brunei[1] in 1858, made a remarkable 55-day expedition along the Limbang river to the edges of the upland country. Much later this route from the middle Limbang up its Adang tributary to the Trusan was developed as an occasional government patrol line and used several times in the 'thirties. But during the Japanese occupation the long depopulation of the upper Limbang was completed, and the Adang emptied; this effectively seals off the whole headwaters for normal travel, and involved me (during 1946) in a fortnight's extra walk through those now uninhabited areas.

Farther south, the celebrated Charles Hose[2] was first Resident on the Baram. He heard of the Kelabit plateau in the headwaters of that mighty river and in 1898 was responsible for sending a native expedition up-river and eastward across the central range to punish hill peoples raiding over into the Baram. Their country (now Dutch territory) was first visited by Mr. D. A. Owen in 1912, four years after Douglas[3] had visited the upper Baram, but to this day the source of the Baram has not been exactly located, although I was within a few miles of it when climbing Apad Runan (7300 feet), perhaps the third highest mountain in Sarawak.

Visits from whites have remained few and erratic. Generally once in two or three years an administrative officer patrols through part of the Uplands along one of the better defined tracks. No one resided there until 1945. The upland boundaries separating Sarawak and Dutch Borneo have not been accurately surveyed, and overlap by as much as 20 miles on different maps: the northern Dutch border abutting on British North Borneo was cursorily defined before the war. During wartime parachute operations we were often uncertain which country we were in. When we built an upland airfield, on some maps it was in Sarawak, on others in Dutch Borneo. Much confusion resulted and some of it reached the highest political level, for the Dutch at one stage misunderstood the intention of British activities inland.

[1] Spenser St. John, 'Life in the forests of the Far East,' vol. 2. London, 1863.
[2] Charles Hose, 'Natural man: a record from Borneo,' London, 1926.
[3] R. S. Douglas, *Sarawak Museum J.* 1 (1912) 17; and manuscript notes, courtesy, D. A. Owen.

In 1945, several Service bodies compiled special and "up-to-date" Borneo maps, first for American bombing operations, then for Australian landings at Tarakan, Brunei, and Labuan. The R.A.A.F. 1/1,250,000 map (1945), though more accurate than the U.S. Army Air Corps 1/1,000,000 (1944), makes the whole Trusan flow in a sea-level valley; it elevates Mt. Kinabalu in British North Borneo to 19,000 feet in response to the pilots' belief that this peak was Himalayan, although it has been climbed and fixed at 13,455 feet. No wonder planes often dropped our supplies in the wrong places, or got lost. The Australian Army's 1/250,000 version (1945) shows the Trusan as an almost straight river, running up into country correctly marked "unsurveyed." When pilots found their own maps useless over the interior they tried this Army map and went as badly astray, since the Trusan has in fact a particularly complicated and erratic course. The earlier Army map (1944) was at least less misleading, in that it left out the mighty Trusan altogether! The combined Dutch–U.S.A. map, "Oost Borneo" (1/1,000,000) is a fine work of imagination. It shows, for instance, the landmark Gunong Murud (Malay name) twice, once as Moeroed Piek (Dutch for the same) 20 miles away from Gunong Murud and 1000 feet higher; while the U.S. Army 1/1,000,000 (1944) puts it miles off as Moeloek. The R.A.A.F. 1/1,000,000 (1944) omits Murud completely. None of the main maps in use showed Batu Lawi, although its twin white pinnacles proved far the most distinctive landmark in the interior (see below) and key to all upland flying and dropping operations. These errors[1] were partly due to faulty coordination of the limited existing information, partly to the large areas blank on the map which challenged the tidy minds of armchair strategists in Washington and Melbourne. In consequence, scores of downed airmen, and not a few ground troops, lost their lives unnecessarily.

The Dutch, though they started last, have been the most energetic both in survey and in parallel interior administration. Their forestry survey, for instance, was ahead of any British. Inland they maintained an educated Malay with the rank of District Officer to each district of over six thousand people, acting under a Dutch Controller at Malinau near the east coast. At Long Nawang, a large village in the upper Kayan river (the middle stretches of which were approached by Hose in 1898), they established a pre-war headquarters, with white personnel and native troops. The object of this has never been quite clear. Long Nawang is an awkward place to reach by river transport owing to a break of about 20 miles where the Kayan enters the spectacular Brem Brem gorge, necessitating a difficult porterage; on average, the journey takes one month. Nor does this give effective control of the interior, since the Kayan is cut off from the Upland country to the north by a series of east-and-west mountain chains. It does however give best *access* to the headwaters of the Rajang river in Sarawak.

From the Dutch side, the effective literature on the Borneo interior is even less than from the British. Elmshout's study of the Long Nawang Kenyahs is an authoritative work; there is nothing worth while on the Dutch hill tribes. Long Nawang, because of its relative accessibility and militarized "security," has attracted a trickle of travellers, mostly American. The latest, Charles

[1] I hasten to add that the appended sketch-map may correct a few errors in broad outline and is bound to perpetuate others.

Miller,[1] in 'Black Borneo' meets orang-outangs, one of which kills his cameraman with a single blow—an appreciable extension of this ape's known strength and a striking extension of its known distribution. Not content with finding the Kenyahs still active headhunters ("the village was blood-parched and now the end of the drought was in sight") he also discovers cannibals and sadists. Here is his report on one river lady:

> "When the butchery of her sweetheart did take place, she had with her own little hands cut off the fingers of the slain youth and used them for decorations on a new hat. Women, she assured me gravely, knew lots of tricks like that, and when it came to carving up a human body for a cannibalistic feast, only women knew how to select the choicest morsels."

I feel that if Mr. Miller had ventured into the more difficult hill country he would have made the present paper appear poor and insignificant indeed.

The recent awakening of American interest in South-east Asia has also started a flow of more academic works. Two recent ones, under the auspices of Chicago University [2] and Institute of Pacific Relations,[3] are inaccurate about the interior and about Borneo generally. Borneo has long been a happy hunting ground for armchair authorship—starting from 'The adventures of Rueben Davidger.' [4]

My own knowledge of the interior originated in the 1932 Oxford University Expedition to Sarawak, which concentrated on the Baram basin, though I also made a journey into the Rajang.[5] We heard then of rich plains farther inland, and I remembered this when looking for a place behind the Japanese lines from which to initiate intelligence work and guerilla activities prior to Allied coastal landings. My fuller knowledge, arising from this, is based on a series of reconnaissance flights with the 13th U.S.A.A.F. and the R.A.A.F., December 1944 to February 1945; seaplane landings on the Rajang and Baram rivers; three parachute drops and subsequent foot journeys throughout the uplands—of which I was Military Commander; numerous flights from our upland airfield after June 1945; and subsequent extensive peacetime foot and canoe travels (totalling about 3000 miles) when I remained to rehabilitate the interior (until August 1946). As a result, I have covered most of the blanks on the map, visited the headwaters of the main river systems, crossed the interior in many directions, climbed the main peaks, and made inland-to-coast journeys *via* the Tinjar, Baram, Tutoh, Limbang, Trusan, Mentarang, Bahau, and Kayan rivers. As my studying was necessarily incidental to military duties, it is incomplete.[6] The attached map is correspondingly rough.

[1] C. Miller, 'Black Borneo,' London, 1946.

[2] Fay-Cooper Cole, 'The peoples of Malaysia,' New York, 1945.

[3] B. Lasker, 'Peoples of Southeast Asia,' New York, 1945.

[4] J. Greenwood, 'The Adventures of Rueben Davidger, or seventeen years' captive among the Dyaks of Borneo,' London, 1865; *cf.* M. T. Perelaer, 'Ran away from the Dutch,' London, 1887.

[5] T. H. Harrisson, "The Oxford University Expedition to Sarawak, 1932," *Geogr. J.* 82 (1933) 385–410.

[6] I hope to fill in gaps during 1947–48, when I shall once more be alone in the Uplands, on behalf of the Sarawak Government. A quantity of observations have been made, including time and compass traverses and panoramas from mountain peaks. It is hoped to collate these data presently if (as now seems probable for climatic and other reasons) an early aerial survey of the uplands proves impossible.

I owe much to my comrades-in-arms, especially G. S. Carter, D.S.O. and George Crowther of Sarawak Oilfields, N. G. P. Combe, M.C. (British North Borneo Service), and W. L. P. Sochon, D.S.O. (Sarawak Government); also to Paul Bartram, Col. John Chapman-Walker, O.B.E., Lt.-Cols. J. Courtney, M.C. and J. Findlay, O.B.E., K. Digby and the *Sarawak Gazette*, D. Leach and the Sarawak Survey Department, C. H. Southwell (Borneo Evangelical Mission), W. S. Singall (Dutch District Officer), Dr. E. Schneeberger and P. M. Synge. But above all to those illiterate Kelabit and other tribal chiefs, led by Penghulu Lawai, B.E.M., who from first to last treated us as their own sons, thus making this paper (and much else) possible. I have to thank P. M. Synge and G. S. Carter for some of the photographs.

The far Uplands

The little-known interior of this great island can conveniently be considered in three diminishing blocks:

1. Behind the coastal plains—inhabited almost entirely by Muhammedans, Chinese, and the small white population—is the Interior, where hills and jungle take control. Over most of Borneo, this interior starts within 20 miles of the coast. It is inhabited by pagan tribes, including Dayaks, Kayans, Kenyahs, Dusuns, and the hill tribes. These groups have different languages, but many physical and cultural characteristics in common. They live in the long-house type of village community. Most cultivate rice in jungle clearings. All have straight black hair and medium-brown skins.

2. Far within the interior, in an irregular box formation across the northern headwaters, lie formidable mountain barriers; here the rivers become too rocky and rapid to be normally navigable. Beyond and behind these tangled ranges are the Uplands, inhabited by the hill tribes—people who walk (or slither) everywhere, and have a correspondingly strong, tough physique and character.

3. In the very heart of the Uplands, where Sarawak, British North Borneo, and Dutch Borneo meet, are curious plains—the Tablelands.

This paper is not concerned with the interior as a whole but with the seldom-visited Uplands, including the most interesting central Tablelands. There is generally a 6000-foot mountain belt, inhabited only by nomadic Punans, dividing the uplands from the interior lowlands, where travel is in relative comfort by canoe on navigable rivers. The line of definition varies in distance from the sea. On the Baram it is at Liomatu, nearly 200 miles from the mouth. On the Limbang it is at nearly the same distance. But on the Trusan the land rises rapidly about 25 miles inland. The Mentarang is navigable for some 100 miles up to Long Berang; then there are about 13 miles of quite impossible water, until with the Kerayan and Bawang tributaries there is open, muddy water which can be travelled in the flimsiest canoes. Every river rising in the uplands has some such major break of gorge and fall, varying from 15 to 50 miles in width.

To the east, around the head of the Mentarang river in Dutch Borneo, the barrier is less defined than elsewhere. On the west side, the barrier is most complete in the headwaters of the Limbang and Tutoh rivers; it took me eight

days' hard going to cross this barrier from the Limbang into the inhabited uplands of Libbun and Trusan. No hill man I met had attempted to cross the barrier from the last river village on the Malinau to the first upland village on the Seridan river farther up the Tutoh. But according to the indefatigable Punans—who are able to travel continuously, living off wild sago-palm and game shot with the blowpipe—it takes a month. This part of the barrier is a serious obstacle to hill people on the Seridan.[1] Some years ago a party tried to break through by canoe. Nothing more has been heard of them although some decades ago several parties succeeded.

The barrier to canoe continuity is of importance culturally and historically. For centuries it partly cut off the uplands from the river peoples and from intimate commerce with the coast. It left most of the uplands in comparative isolation, to develop their rather different way of life. It gave the hill peoples an independence of economy and outlook, which incidentally proved invaluable in the war when they made first-class guerilla fighters.

The uplands, although almost on the Equator, are comparatively cool. At night, at least one blanket is required. It is hot in the daytime, though seldom oppressively so. The rainfall averages probably 200 inches a year. During my first eighteen months, it only rained three times during the morning. There are occasional periods without rain—a week is my record. The coastal monsoon is obscured, since mountains screen the area from wind-carried rains. This creates a daily rhythm. Although there are few seasonal changes, there is a distinct periodicity in animal and plant life. This distinct persistence of life-cycles is parallel to those already described by the Oxford Expedition to the New Hebrides [2] under somewhat similarly equable conditions.

Although the climate is comparatively pleasant, it is extremely damp both overhead and underfoot. During the night, cloud forms in each valley bottom. It rises with the sun, clearing after about three hours. When planning parachute entries, we wasted weeks flying over at dawn when the lower ground (with possible clearings) was always obscured. Flying as we then were without maps and from very long range (since the Allies held no point nearer than Morotai in the Halmaheras), the time available to cruise around looking for an opening in the cloud was only measurable in minutes. Resultant abortive flights put a strain on all personnel and lost us several Liberators. In the end, tired of delay, we dropped through cloud. The first four landed exactly on that Bario tableland of which I had heard thirteen years before. The others dropped into jungle; it was only through the junglecraft of Captain Eric Edmeades, M.C. (now of the Sarawak Constabulary) that they eventually regained contact.

It is easy to get lost in this Upland jungle. Apart from the jungle's featureless density, in the Uplands the chaos of crossing and recrossing ranges and streams, running in all directions, adds considerably to the difficulties of direction finding (and keeping). In an attack on a Japanese post near the head of the Sembakong river (north border of Dutch Borneo), one of our guerillas was slightly wounded and lost touch with his troop under Captain F. Blondeel, M.C.

[1] T. Harrisson, "Notes on nomadic Punans" *Sarawak Museum J.* 5 (1949) no. 1. p. 130.

[2] J. R. Baker and T. H. Harrisson, "The seasons in a tropical rain-forest (New Hebrides)," *J. Linnean Soc. London, Zoology*, 39 (1936) 443–62, 507–18, *et. seq.*

After a week, in accordance with local custom, his relatives celebrated his departure to the other world by slaughtering his cattle and converting his surplus rice store into alcohol. During the orgy that ensued he reappeared. He had cut his way with a home-made knife for eight days across the ranges, emerging by chance on a river which he recognized from a previous hunting trip. On another occasion, Sergeant W. Nibbs (an Australian parachutist with over a hundred jumps to his credit) was ambushed by Japanese. He had to jump off the track; in doing so, he lost touch with his companions. It took him two days' hard slogging before he could find a way back to the village which he had just left. Others (including local people) are lost, never to return.

Although this jungle closely corresponds to that of the lowlands, the Uplands can properly be regarded as a broad ecological and cultural unit. The outer fringes are characterized geologically by wide strata of quartzite with shales, like those west of the Sembakong or along the Toeboe and Kaloen on the eastern edge of the Uplands, with a similar formation on the south-west side, in the middle-waters of the Baram near Liomatu. From the upper Baram north runs a wide, erratic belt of friable limestone, of which the whole peaks of Murud, Batu Lawi, and Apad Runan are composed. South, on the Bahau, there are varied sandstones, frequently in close-layered formation, including a "pepper-and-salt" type found throughout the Central Uplands. A conspicuous feature, while footslogging through so much uniform jungle and mud, is some sudden area of red clay. Basins of this, intermixed with sandy shales and very fine friable sand, commonly appear in areas of tableland already mentioned. These have remained little studied since St. John mentioned with disbelief Limbang native accounts of far inland "smooth water which stretched for several days' journey, flowing gently through a vast tableland; of the tame goats without masters which thronged this region—but I could find no one who had seen any of these wonders"—a fair exaggeration of the upper Kerayan!

Tablelands

The principal flat, rich lands (see map) are around Bario and in the headwaters of the Libbun; at Bah Kalalan in the head of the Trusan; at Bawang and Balawit; and again at Lemboedoet and Pa Koerid farther south on tributaries of the Kerayan; and along the main Kerayan in the district of Benoeang. All lie within a narrow rectangle about 30 miles north and south, 15 east and west, and over 3000 feet above sea-level, mainly in Dutch territory.

I found subsidiary pockets of the same nature in Sarawak on the upper Trusan, on the Balleh and Balong above their junction with the Baram, and in one or two places on the Tutoh; in Dutch Borneo on the Poedjoengan and Berau tributaries of the Bahau. The upper Baram river people describe more of this terrain on the Danum and Plieran branches of the Rejang, which they once inhabited in large numbers.

In all, these pockets of tableland cover little over a thousand square miles. But they are richly different from anything else in the interior, a difference striking not only to the outsider but to native mentality in general. The shock

of pleasure when emerging into one of these tablelands after a long jungle spell is best recaptured from my diary:

> "After weeks with an horizon of not more than 30 yards, the sun always obscured by the forest canopy, I feel literally faint on coming out into the open, the clear sunlight, the perspective of distance, flatness, intense fertility, still water, colours other than green, a complete view of clouds or stars, and the rain pushing straight into you instead of dripping down your back off the branches. Above all, the conviction that you can walk twenty paces without collecting another leech."

Brigadier Fergusson [1] well describes the same sensation after two months in the perhaps less severe jungles of Burma, on emerging into Kachin rice fields, "this smiling valley" which left him "gasping at its beauty." The Borneo tablelands are divided up into a beautiful checkerboard of fields dotted with long-houses, rice huts, and pig-sties. The inhabitants have cunningly carried hillside trickles to irrigate miles of valley and, in Dutch Borneo, bamboo pipes bring spring water direct to the long-houses for cooking and washing (they seldom drink water). Although the Tablelands teem with buffalo and humped-back cattle, these are not used to till (or for milk). Rice crops are nevertheless extensive, and these are supplemented by fruit, vegetables, pigs, goats, fowls, spring salt, and leaf tobacco. Whereas the lowlands are frequently short of food—in 1946 the Kayan and Baram rivers were near starvation—the upland people generally, and the tableland people in particular, have an abundance. Thus I was able, without previous arrangement, in a few days to buy enough surplus rice (at 1½*d.* a lb.) to supply the whole war-affected population of sub-coastal Brunei Bay and north-east Dutch Borneo.

The Bario plain in Sarawak (on which we first dropped) was the poorest tableland. We discovered the larger, richer Dutch ones when one of my medical orderlies, Sergeant F. Sanderson, D.C.M., went east to investigate a report of some shot-down American airmen surviving in that direction. I quickly moved my headquarters to this lovely district, which gave abundant food and labour as well as better access north-west to Brunei Bay, north to the Padas, east towards Tarakan Island and other Allied objectives. Later, after the Tarakan landing had brought planes within reasonable flying range, we were able to build an airfield here, with benefit to ourselves and to American airmen we rescued. (One afterwards wrote a stirring tale of how he rescued *us*!)

In addition to these plains, there are extensive rolling grasslands in the headwaters of the Bahau. These too are wonderful to enter after a long period of jungle. I first saw them from the air in a 1944 reconnaissance flight. They looked too rough, too eroded, to be suitable for parachute operations. But later (after ground reconnaissance by Lieut. J. Westley, M.B.E.) I was dropped there on an emergency job, to save several weeks' walking. In 1946 I travelled on foot from Bario back into these grasslands—a twelve days' walk (30 minutes flying). Despite its pleasant appearance, this is not good country. A hard sandy clay with thin top soil radiates intense sun-heat; flies and mosquitoes abound; the ground is poor; the people are correspondingly poor. The most striking feature is the quantity of game, including the largest species of red

[1] Bernard Fergusson, 'The wild green earth,' p. 82. London, 1946.

deer and many wild cattle. These give a park-like appearance as they browse on the beautiful pale-green hillsides, with the impassable Bahau a silver line of loveliness far below.

Warrant Officer Macpherson, M.M., also located similar small grassland areas around Iburu and Bole on the Meligan tributary of the Padas (British North Borneo). As there were no other suitable open spaces in the area, we developed and extensively used this zone in dropping operations around Japanese G.H.Q. at Tomani on the middle Padas.

The spinal range

Within the mountain barrier and throughout the Uplands run a multitude of small ranges, such as the Sarawak Tamabos. Only one is really symmetrical, the spinal range, which runs continuously at 5000 feet and up to 7000 feet north and south from its low passes between Kayan and Rajang rivers (behind Long Nawang) through Batu Kalong. It passes the source of the Baram behind Apad Runan, and then drops slightly before the spurs of the Murud complex at above 7500 feet. It then passes into the Trusan and runs between British North Borneo and northern Sarawak, on for another 100 miles into the Crocker Range. Thus for 300 miles there is no divide, until the gorge where the lower Padas, turning after its long course north from the Uplands breaks westward into Brunei Bay.

The whole way along the spinal range on the western side, rivers run fairly directly westward. On the eastern side the valley levels tend to be higher, the rivers to run much more erratically and often parallel with the range. Innumerable others radiate out from the spine—the irregular ribs of Central Borneo. There is always a range awaiting you at right-angles to any line of march and there is no avoiding constant climbs up and down.

Just as the barrier *around* the Uplands has separated lowland life and rhythm, so the tempo of life within the Uplands has been largely determined by the spinal range, which was also naturally taken as a boundary by the various governments when first they penetrated the interior. Its height over long distances closes regular human intercourse from one side to the other. Thus the journey from the Baram into the Bahau is, for loaded men, an arduous one, and there is now no other pass for 80 miles southward except a very occasional crossing made by the Kenyah river people. The passes are mostly in the central strip, three of them from the Libbun and the Bario area to the upper Kerayan and Bawang Tablelands. In this area there is thus easy trade and even intermarriage east and west, unregulated by governments or political boundaries. This undoubtedly gives vitality. Those who live in the headwaters of the Dutch rivers farther south or in the upper Padas farther north must rely for their only outside contacts on rivers difficult (or impossible) to navigate in either direction.

Over the interior as a whole the complexity of ranges makes travel and identification of position difficult. Unlike Burma, there is little logical pattern —what Fergusson calls "tilt"—and survey is complicated by a severe lack of landmarks. If you do see a range, if looks much like any other and, as maps were completely unreliable and air crews had no ground knowledge, we were

constantly in difficulty over the dropping of parachute supplies, on which we entirely depended during the first months of 1945 prior to Allied coastal landings.

The only easily identified upland features are:

(1) The twin limestone peaks of Batu Lawi (climbed by me in 1946).

(2) Mount Murud, fairly well defined with its flattened top, but almost always in cloud (climbed, 1946). This would now seem, from observations made by myself on Batu Lawi and by D. L. Leach, Director of Lands and Surveys, Sarawak, from Mulu, to be higher than Mulu, and thus the highest mountain in Sarawak, at about 8000 feet.

(3) The rounded dome of Batu Song, visible from few angles owing to surrounding obstructions (unclimbed).

(4) The saddle peak of Kalulong, about 4000 feet (climbed by the Oxford Expedition, 1932).[1]

(5) Massive Mount Mulu (7898 feet), again constantly in cloud (climbed by E. Shackleton on the Oxford Expedition, 1932).

By the time I left, in August 1946, I was beginning to get to know many of these and other features, having seen them from various angles. Even so, identification was difficult. On these matters native informants are not to be relied upon. Apart from the hunting Kelabits, the hill peoples have had little occasion to travel outside their own localities except on a few well-worn trading routes. Competition among the Kelabits drives them higher, or farther afield. In particular, they make clearings, "rides," on peaks and passes, which are "doors" for the passage of ancestral spirits to the after-life. If a man makes a "door" for his father, a rival will seek to make one higher, farther away, and with greater expense of the manpower which he has to entertain with food and drink during the job, thus showing his wealth and filial devotion. When Dr. Mjöberg [2] attempted to climb Murud for the first time, Kelabits would not accompany him because they feared the cliff spirits. But afterwards, an upper-class man decided to make a "door" there. This was enterprising of him, since the ascent of Murud involves hard travel through uninhabited mountainous country and a difficult last 1000 feet of rock face. He made his "door" a little above the point where Mjöberg camped. In 1945, from another range, I noticed that this door was not at the top; so, when I climbed Murud to take survey bearings, I capped them all! I always made "doors" on new peaks and passes, as otherwise the local inhabitants might have become involved in much tiresome door-making competition. I now have memorials sufficient to reach back to my great-great-grandparents and a high local reputation for dutifulness.

In April 1946 I succeeded in climbing the lower, "female," pinnacle of Batu Lawi with six Kelabits from the village of Bario, where our original party dropped. In a grotto just under the summit I put a plaque in memory of Squadron-Leader Graham Pockley, D.F.C., and Major Ben Ellis, a pioneer

[1] See T. Harrisson, *Geogr. J.* 82 (1933) 393.

[2] E. Mjoberg, 'Forest life and adventures in the Malay archipelago,' p. 153. London, 1930.

British parachutist, who were responsible for our original insertion by Liberator into Borneo and were shot down on the long flight back to the Philippines. The lower peak is almost devoid of vegetation. The only possible ascent is from the saddle between the two pinnacles, along a knife-edge ridge varying from 10 feet to 1 foot wide, between 700 to 1200-feet precipices. The view from the summit is superb, commanding the whole interior. The "male" peak is slightly higher and unclimbable for the last 400 feet. Upon it lived the only peregrine falcon I have seen in more than two years' Borneo travel.

Along some of the valleys around Batu Lawi and north of Murud, there are long wide stretches of immense boulders with the appearance of a great moraine borne from Murud, scouring out the great basin in the head of the Limbang. This is most difficult country to travel, picking a way among gigantic rocks, often over deep chasms and subterranean watercourses, crevasses disguised by coverings of moss and a peculiar dwarf palm. At one point the Limbang disappears underground in this area—another story St. John heard and disbelieved in 1858.

The headwaters of the Limbang are especially misrepresented on existing maps. The last stretch of this fine river curves round *east* of Batu Lawi and rises in the Murud foothills, instead of running miles to the west as it is always shown. Thus, within a radius of one mile from Murud, the Limbang rises to flow south-west and west to Brunei Bay; the main tributaries of the Trusan rise to flow almost due north into Brunei Bay; the farthest headwater of the Baram (the Libbun) rises to flow due south for hundreds of miles to the west coast near Miri; and important headwaters of the Kerayan and Mentarang rivers rise to flow *east* to the opposite coast of Borneo and form the great delta facing the Tarakan oilfields. Murud is, in this sense, the geographical heart of Borneo, centre of mighty rivers and crown of the spinal range.

The moraine type of land in the Limbang is uninhabitable. But in some of the lesser valleys, here and elsewhere in the Uplands, there are fertile areas which have clearly been inhabited in the past. There are indeed many indications that the population of the interior was once far greater than it is to-day. The hill tribes leave their mark on any area they have inhabited by their peculiar stone monuments and carvings, and I have travelled for a week through country now uninhabited, bearing many such sad signatures of past fertility. But most of the central mountains are still virgin forest. Around the summits this gives place to the strange fairy-world of stunted trees, orchids, pitcher plants, and moss which the Oxford Expedition has already fully described[1] as "moss forest"—abominable stuff to struggle through or camp on, let alone in which to hunt Japanese. A peculiar form of irregular "moss forest" appears at lower levels in valley pockets, noticeably on the lower stretches of the Bario–Libbun tableland, characterized by numerous olivaceous shrubs, rhododendrons, pitcher plants, and quantities of stag's horn (*Lycopodium*) on a white sandy soil.

[1] T. H. Harrisson, *Geogr. J.* 82 (1933) 393, 405; T. Harrisson and C. H. Hartley, *Bul. Brit. Ornithological Club*, 54 (1934) 148; and H. N. Dixon, *J. Linnean Soc. London, Botany*, 50 (1935) 57.

Living in the jungle

The Uplands are unified not only by topography (as already described) but also by the problems of life which topography, climate, soil, and isolation impose upon the people. For instance, throughout the Uplands it is rare to travel on flat ground for more than a hundred yards. The ground is often rocky, always leech-infested, and everywhere obstructed by fallen timber which constantly changes the direction of paths—it is less trouble to walk round than to cut through. There are no pack tracks, but innumerable river crossings. The hill people are thus expert walkers. They also specialize in placing long branches or tree-trunks along tracks, notching these into small steps on slopes. They have remarkable balance, and move barefooted along single branch bridges—sometimes over deep gulleys or cliff-faces—without any difficulty.

In the large jungle expanses without man-made tracks, there are generally the remains of faint rhinoceros trails which can be cleared with the native-made and highly efficient bush knives. The pygmy rhinoceros (*Rhinoceros sumatrensis*) is now probably extinct in Sarawak, due to the heavy demand for its horn, valued by the Chinese for medical and aphrodisiac purposes. There are some in the southern part of British North Borneo, and I saw a fresh track on the 5000-foot divide between the Poedjoengan and Kayan rivers in October 1945. The numbers—never great—were rapidly thinned out once firearms became available inland. Prices rose, and in the 'thirties the relics of a rhinoceros were worth a fortune in steel, cloth, and shot to the Upland people.[1] The rhino, with its heavy body and its habit of breaking down small trees for the leaves, is easy to track. As it became scarcer and shier, parties followed a trail for weeks on end along the ranges.

When hunting or exploring it is not usually possible to carry rice for more than a fortnight at the most. At first this prospect is somewhat depressing to the outsider. Even the idea of living off the cultivated and richly inhabited parts of the country was too much for most of my Australian personnel, who preferred to eat tinned beans rather than fresh. The gallant fellows could only be panicked by one thing in war—the loss of a tin-opener. But previous experience in the New Hebrides[2] had convinced me that the best way to live in a country was to live off it. Where there is a successful native population, it stands to reason their diet is as good as any you can (with difficulty) import. During the latter part of my stay I was entirely on my own and without facilities for receiving regular supplies. I then found it was possible to live satisfactorily even in uninhabited jungle areas, provided one moved slowly.

Take from my notes the second week of four I spent on one jungle trip investigating rhinoceros distribution. I was with six Kelabits, carrying a ·303 rifle and several blowpipes;

> *Day* 8. Shot two mouse-deer on river bank. Caught fourteen fish in stream by native trap-net. Recovered bread-fruit floating in river. Palm and bamboo shoots. Rice.

[1] See T. Harrisson in *Malayan Nature Journal*, 1949 (in press), on "The large mammals of Borneo."

[2] T. Harrisson, 'Savage civilization,' London, 1937; and *Geogr. J.* 88 (1936) 97–127, 243–61, 332–41.

Day 9. Got 5-foot water lizard sunning on rock: like mutton. Caught fat pig in trap. Quantity of fruit like mangoes. Plenty of sago, some reed centres. Rice reserves low.

Day 10. Met party of nomadic Punans with dried pork. Shot 6-lb. fish in pool. Tinamou's eggs. Finished our rice.

Day 11. Small fish caught by blocking side-stream. Shot monkey—liver excellent. Found old pineapples and ate leaf bases, just like artichoke. Salad from species of cucumber leaf. Prepared Punan sago.

Day 12. Thirty fish of grayling type. Some edible rush stems. Shot a big lizard; tough. More sago.

Day 13. Green bananas for cooking. Found giant jungle bean; pods up to 18 inches, slightly bitter raw, sweeter cooked. Sago.

Day 14. Shot 70-lb. fallow deer, and a splendid male argus pheasant. Much small fruit. Palm-tops and sago. Wild oranges.

Of course, in or near inhabited areas rice is the staple diet, eaten three times a day, mainly with dried or high pork and delicious fresh fern-tops. The white man however requires more fruit and vegetables. These are easy enough to obtain if you know what is available—for the people will seldom think of telling you. After months I was still learning of delicious new things to eat—for instance, ginger tops, a sort of orchid stem, a special scarlet epiphyte, and a large white toadstool.

I augmented my food supplies with seeds brought from Australia. Some Javanese whom we rescued from the Japanese at various times made first-class gardens at several tableland villages. Here we grew potatoes, tomatoes of several varieties, shallots and spring onions, cabbage (with only moderate success), lettuce, silver beet, monster radishes, egg fruit, spinach, marrows and pumpkins. Their seeds were subsequently distributed to villages all over the interior and I hope will flourish.

THE HILL PEOPLES

So little study has been made of the upland peoples that the general unity of the population has not been recognized. The division of the interior into three territories previously prevented anyone moving freely over the uplands as a whole. But in 1945 and 1946 the only boundary was war, and I happened to be the only effective authority throughout the uplands. Pollard [1] noticed affinities between the Trusan Muruts and the Baram Kelabits; and the Muruts nearer the sea have been broadly described.[2] In general however, whereas we know a good deal of the lowland river peoples, we know extremely little of the hill peoples. Many textbooks appear unaware of their very existence. As I came to be the first white man to live in the uplands and to travel them widely, I can add to the existing data.

The main elements of Borneo population are fairly clear-cut. All Chinese, Malays and native Muhammedans live in the coastal and sub-coastal belt.

[1] F. H. Pollard, *Sarawak Mus. J.* 4 (1935) 223.

[2] Owen Rutter, 'The pagans of north Borneo,' London, 1929; C. Hose and W. McDougall, 'The pagan tribes of Borneo,' London, 1912.

With few exceptions the well-known Dayaks inhabit the sub-coastal belt. In the interior lowlands are the river groups, canoe people, principally the Kenyah,[1] Kayan, and related types. Within these again are the hill groups of the uplands whose geography I have already described. The mountain divide between lowland and upland is inhabited by a number of groups of nomadic Punans.

The distribution of the hill peoples is complicated. Thus the hill Muruts overlap to the coast at Lawas, while the river Kenyahs on the Dutch side have been edging up-river and pushing back the Beraus. But despite intricacies of tribal relationship, it is possible to define a distinct hill group at the present time, and one which relates in several respects to other hill peoples in Burma, Indo-China, the Philippines, and elsewhere. The Borneo hill people cover about 10,000 square miles, in the chaotic network of valleys and rivers which constitute the Uplands as already defined.

Although in some places they can use canoes, these are always crude and foot travel is the regular mode. Hillmen would rather walk; the river people are generally reluctant to walk at all. I was once on a difficult stretch of the journey with river Kenyahs up the Kayan river; we were held up by one of those floods liable to happen there at any time of year. We had been travelling for twelve days without adequate food, for two days living on green bananas, as there is no original jungle left near the river for hunting and foraging. The winding river at this point suggested that by intelligent walking we could probably soon reach the next long-house. But the Kenyahs would not have this at any price. With one hill man as my companion, I reached the village that afternoon and fed well for three days—until the arrival of the canoe crew, now half-starved.

The hill people are divided into several fairly distinct groups, although no rigid classification is practicable:

Name in common Upland use	*Approx. total population (mid-1946)*	*Main distribution*
MURUTS [2]	?5000+	Trusan and Lawas rivers and middle Limbang (Sarawak); south of British North Borneo border (Dutch Borneo).
POTOKS	18,000	North-west Dutch Borneo, excluding tablelands.
MILAUS	2100	Main Kerayan Tablelands (Dutch Borneo).
BRIANS	*c.* 3200	Tablelands in extreme north-west corner of Dutch Borneo.
KELABITS	1800	See below.
SABANS (and TABUNS)	300	On the extreme upper Baram and Bahau (Dutch Borneo), and the Madalam tributary of the Limbang (Sarawak).

[1] There is no "proper" spelling of this term, and Kenya (Kenja in Dutch) is equally apposite on some pronunciations. All these terms are externally imposed.

[2] The Adangs mentioned by St. John (*op. cit.*) and by Hose and McDougall (*op. cit.*) are only the upper-Limbang branch of Muruts, named after a river which they have

The present-day total is thus under 50,000, a shadow of the past population but still a sufficient nucleus to turn the fertile uplands presently into a dynamo of Borneo culture.

Around the hill population there are transitional groups, especially the few remaining Beraus on the remote upper Bahau and the wild Kaloen, among whom I stopped for a time. Hose and MacDougall previously heard of them as "Trings" or "Apu Asing." They appear to be something between the hill people of Murut type and the nomadic Punans, with peculiar customs (*e.g.* no long-houses) and intense superstitions of their own. In the south-west of British North Borneo the Muruts merge into the Tagals. Some of these are topographically hill people, but part at least differ in physique, language, house construction (a central dancing "pit" instead of verandah), ethics, morals, and methods of agriculture (largely root crops). The Muruts of the Padas and Potoks of the Mentarang will not allow the Tagals as any relations of theirs, especially since they murdered several shot-down American airmen, distributing their heads for ritual purposes. This treachery infuriated others who ran great risks assisting these airmen. The plain Dusuns much farther north are something between hill and river people, all of whom presumably come from one main stock.

All these hill people (as herein defined) share one type of language, though subject to considerable local variation—the Kelabits, for instance, slurring and clicking phrases almost out of recognition. All prefer small villages operating in communities of 50 to 150 rather than the larger units favoured by river people. They make a type of long-house lacking room partitions. And they are great hunters and farmers. The river people, often with easier land, are frequently short of rice and other staples; this is rare in the hills. The hill way of life tends to make the people more energetic and virile; thus during the war they proved outstandingly bold as guerillas. On the whole, I found these peoples more logical and sensible than any others I know—of course there are many individual exceptions. They are less restricted by superstition and illogical fear than the lowlanders, more capable of weighing up a case on its merits. They use precedent as a guide rather than as doctrine.

One of the least known of the hill groups is the Kelabit, previously described only *passim*, notably by Banks [1] in connection with their stone monuments. They now inhabit the remotest part of Borneo and have remained in some ways more intact than other Borneo peoples. Having originally been dropped among them, and having to use them as the base-line of most upland activities for eighteen months, I came to esteem them highly. Despite serious faults, including snobbery, boasting, and alcoholism, they proved intelligent, gay, sane, loyal, and consistent both in war and peace.

now vacated in favour of the Trusan. Other terms are also used. My travels north-eastward did not extend beyond the mid-Padas, and I am uncertain of the exact definition of Murut territory and their relationship to the Tagals in particular. Rutter (*op. cit.*) and some others have never gained a complete view and experience of the up-country Muruts, and the position is less clear for that. In fact, the whole definition of these groups in Sarawak and North Borneo is most confused and even contradictory. I hope to elucidate the matter further by research on the spot.

[1] E. Banks, *Sarawak Mus. J.* 4 (1935) 405; also *cf.* T. Harrisson in *J. South Seas Soc.* (1949) (in press).

Kelabit life and death

The Kelabits to-day number under 2000, concentrated in twenty-two small villages of the farthest Borneo hinterland above 3000 feet, thus:

Two in headwaters on eastern slopes of the spinal range (Dutch Borneo).
Four on the Madihit, headwaters of the Limbang (Sarawak).
Five in Tutoh tributaries of the Baram (Sarawak).
Eleven at the head of the Libbun and Kelapan (Baram)—one mixed with Sabans.

Single families also live in several river villages on the Baram.

The most striking thing about the Kelabit is his appearance. Many Kelabit men are decidedly tall, and noticeably long in the leg and strong, though slender, in the thigh. This is presumably an adaptation to mountain life, for here you must not only walk, but climb. Kelabit children are agile and tough, their parents particularly devoted. I have seldom heard an angry word spoken to a child, though once or twice I have myself ached to administer a sharp smack to some naughty boy. Family life is generally stable so long as there are children; there is a wide measure of pre-marital promiscuity.

Both sexes are fond of ornament, more so than any other Borneans. Quantities of bright beads—some closely similar to specimens from Ur and ancient Egypt [1]—are worn by both sexes, with large numbers of arm and leg bangles. The men wear clouded leopard teeth in the tops of their ears, a habit now almost extinct elsewhere. The women follow the unsightly custom of extending the ear-lobe below the shoulder by heavy weights; men extend their ear-lobes to a lesser degree. All of them, and especially the women, make up for lack of looks by an open, jolly disposition. They are warm-hearted and responsive. Laughter is the commonest noise of their long-house life. They laugh at much the same kind of thing as we do—but we do it less often.

The long-houses have a central wall full-length down the house, with a social and bachelor verandah on the front side, numerous family rooms down the back, the whole on posts 5 to 20 feet above ground. Kelabit houses are especially well made and completely walled in, light being admitted by movable panels in the leaf-thatch roofing. This gives an extra closeness and cosiness, and is a necessary measure against the cold winds blowing down from the encircling mountains. The natives sleep completely rolled up in mats alongside fires which are blown and revived through the night. The closeness of life is emphasized by the absence of partitions in the family quarters. Each family has a marked-off section, but you can and do walk freely up and down the back. Everyone can see what everyone else is doing, down to the least domestic detail. Naturally this leads to a give and take, a comradeship not found among the walled-off room-living river people.

The stranger finds this rather exhausting. Not only do Kelabits not require privacy; they cannot realize that anyone else can require it. I was never able to keep people out of the personal hut I built at Bario after the war. At times I felt I *must* be alone to do accounts or write a report. I would put two police at the door with orders that "even Tuan Rajah may not enter," and threat of

[1] H. C. Beck, *Man* 30 (1930) 134; T. Harrisson, paper to the 7th Pacific Science Congress, New Zealand, 1949. (To be published in the *J. Polynesian Soc.*)

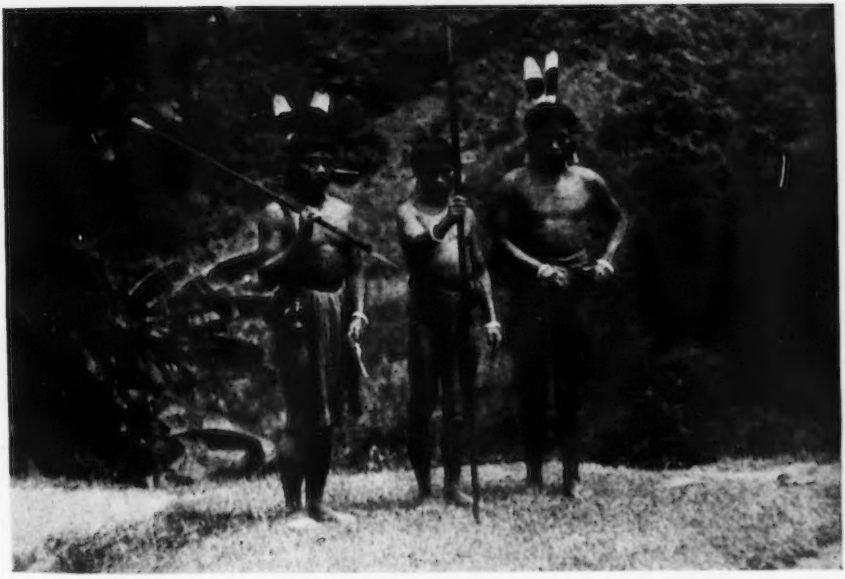
dire fine if anyone got in. But as the police were themselves Kelabits, it was futile. In the end I gave it up. Of course, in a long-house it is far worse. All night long there is noise. Adults require remarkably little sleep. It is common form to sit up and talk till 2 or 3 a.m., and to wake and start talking at 5.30. Drinking parties often begin at midday and go on till dawn.

They also like to sing and to play their four-string bamboo mandolins before daylight. They do this nicely; but no music is really nice at *that* hour, what with the cocks (which freely roam the house) uproaring the dawn, and the usual gang of small boys dashing around on some hunting game. Yet, once you are used to it, there are many compensations. Chief among these is the general atmosphere. There is no such thing as an outsider in a Kelabit home. You could not be one if you tried. This way of life leads families to share food and hospitality as easily as to share talk and laughter. The Kelabits are almost overwhelmingly hospitable—unlike some river folk. Under this social surface there is a strong class structure, and a slave element in the past sold or even slain like cattle. Class status almost entirely depends on heredity, related to the possession of the older type of brown pottery Chinese vase (? Ming and sometimes earlier) worth over £100 in Kelabit values. There are less than a hundred of the oldest vases; aristocracy is correspondingly limited. Persons do not normally marry outside their class. Chiefs exercise considerable authority. Although women play a less direct part in influencing discussions and decisions, they do much to shape male opinion.

Within the upper classes there is a strong competitive individualism. Thus, the Kelabit country is a world of Rajahs and Tigers. There are men called "I am too great to work"; "Thousands work for me"; "When I summon all men come"; "A Thousand Bodies." Lawai, of Bario, started a vogue some years ago when he called himself "Tuan Resident." Another man countered this with "Head Tuan," to which another rapidly replied with "A Thousand Tuans." Then over at Kubaan a man named himself "Tuan Rajah"; another answered with "Rajah King"—only to receive an immediate reply "I ignore all Rajahs." All have now been eclipsed by a "Tuan Allah." Each male wants to demonstrate his superiority to the next. This is, of course, common to most men. Among the Kelabits it has been elevated to a focal interest, class conditioned.

A common form of boast is to say how many buffaloes, cattle, and fat pigs you have slaughtered in funeral celebrations for your relatives. The man who has killed most animals has the edge on all others. The worst insult you can pay a Kelabit is to tell him he is too mean to kill off his own animals for his father's memorial rites. Ambitious men are always stepping-up the pace by additional slaughters. In the old days, the main item of sacrifice was the large red deer, captured alive in traps and kept in pens, fattened by over-feeding. Since the pacification of the interior, the spread of water buffalo and humped-back cattle up from Brunei Bay gradually reduced the ritual importance of deer. This spread is even yet very incomplete. It is now proceeding southward over into the Bahau river, and similarly down the Tutoh on the Sarawak side. Within a surprisingly short time the Kelabits developed their own herds from Murut stock, and turned an import trade into export. They are now reluctant to sell females to the river tribes lest they breed on their own account.

Kayans of the Baram river, Sarawak



Tagals of the Murut group with blowpipes, North Borneo

Kelabit Headman, Sarawak

Iban woman, sub-coastal area, Sarawak

Kelabit hunter

The hill people have correspondingly lost interest in goats, recorded from the upper Limbang ninety years ago by St. John. Goat's hair is still valued as decoration for sword handles, shields, and dancing hats.

Fine shields and swords—originally made from iron extracted from the ground—are mainly made by the Kenyahs on the Bahau river, though the Kelabits make their own everyday models. These Dutch Kenyahs are probably the best metal craftsmen in the country, making wonderfully delicate steel blades which they trade to Kelabit and other hill people in return for cattle, hill salt, and tobacco. Good specimens are highly valued and used only for show and ritual purposes. These material types of property are handed down from parent to child over generations. (Inheritance is from either parent, in a complex division between offspring of both sexes.)

The Kelabit himself is not so much a craftsman; he is primarily a farmer. Other inland peoples have long periods when they can do no work because of omen, superstition, and spirit propitiation rites. If the wrong bird or snake appears they abandon whole rice clearings. Indirectly influenced by Malay Christian teachers in the Dutch uplands and by myself, the Kelabits have in recent years abandoned all this, while retaining the rest of their beliefs and customs. They can thus work more nearly on a pattern of logic and plan, not so much on illogic and chance.

They take much trouble to cover their rice fields with an elaborate network of vines attached to bamboo clappers all around the edges and operated from a central hut. Along the centre of the field runs a log bridge about 7 feet above the ground. On this people walk all day long (once the rice is in ear) shouting and scaring the parrot-finches and doves. Dotted around are scarecrows and poles with windmill arrangements on top, creaking fearfully in the least breeze. Pig traps, generally spikes on to which the animal is frightened by a bamboo spring-clapper, are placed round the field.

Lest the rice fails, they are careful in rotation of crops. As soon as the wood felled in clearing the rice area has been burned off, they plant Indian corn; this ripens when the last rice stores may be running low. When the rice blades are about 3 or 4 inches high, manioc is planted; this matures about two months after the rice and is mainly used for fattening pigs. Cucumbers, shallots, marrows, sugar-cane, and the usual fruits are also cultivated.

The Kelabits grow much more rice than they need to eat. They may drink almost as much again. Every sort of event—especially the only too frequent death feast—is excuse for alcoholism. On the first death festival, the previously dried-out body of the deceased is removed from a tree-trunk coffin to a special site in the jungle. A drinking bout follows. On the second death feast, a year or more later, all the guests, after a great party, make a memorial to the deceased. This may be a cleared stretch ("door") on some high skyline; or a monument of upstanding stones, commonly in pairs, one taller than the other, and roughly resembling the extraordinary twin limestone peaks of Batu Lawi which dominate interior views; or a flat stone "table" (dolmen). There are also remarkable drawings and carvings in stone throughout the area and intricate legends associated with them. As always in Sarawak, the designs are dominated by an inability to draw straight lines, by the spiral obsession

of the crocodile tail, hornbill's casque, snake, leopard's teeth, or twisting vine.

A common excuse for alcoholism is the arrival of any distinguished visitor. Of all visitors, the white man is the most esteemed. The qualities they look for in a white are a sense of fun, approachability, good temper with firmness of decision; and (inevitably in the Kelabit mentality) a capacity for rice beer.

For the guest, the bombardment of rice beer is hard to take. Kelabit beer is weaker, more bitter than most varieties. It is served in porcelain dishes or plates, some of fine design. The stuff can be prepared in five days, unfortunately, since quantities can be prepared at news of your approach—which will always be at least a week ahead of you. The consequent "party" may involve anything up to sixty tall Chinese jars of beer, constantly replenished by adding water from bamboos.

The etiquette of such drinking is elaborate. The socially senior person is served first; the distinguished visitor has dish after dish pressed upon him. The lower classes sit out on the perimeter, until gradually all barriers break down and people are serving each other in all directions, amidst an indescribable babble of conversation and that loud laughter beloved of the Kelabit. The drinking is accompanied by songs in honour of the visitor, or in commemoration of past events. Kelabit singing is varied and dynamic. I doubt if the few previous visitors heard their rich native song styles, since they entertain usually by singing in the lowland manner. For they have (or had until 1945) a definite inferiority complex, feeling that they are up-country cousins, looked down on by the more sophisticated people nearer the coastal centres of government and education. This is not a negative feeling. It makes the Kelabits anxious to improve their status in relation to peoples more "fortunately" placed. They have indeed led Sarawak in abandoning restrictive customs based on superstition, without throwing over their whole past. And they have not, unlike many remote peoples, developed a mentality circumscribed by the accidents of their own geography. Their interests reach out over the great mountain ranges which encircle them. They are tirelessly interested in ideas, aeroplanes, Europe, the solar system, other peoples' customs and wars.

The Upland Future

The direct influence of the white man in the interior was extremely slight before the war; his indirect influence was important. Headhunting was brought under control in the *lowlands* at a fairly early stage in the country's governmental history. The relatively inaccessible upland peoples continued warring long after. This finally led to a series of harsh punitive expeditions which eventually convinced the hill folk that it was safer to keep quiet. Peace brought a new atmosphere; in place of the everlasting fear of sudden ambush, night-stalk or lightning raid. People could now concentrate on doing their jobs properly. Women could work without guards. Rice production soared—and people became increasingly alcoholic. This made them the more susceptible to those diseases which are usually the first contribution of white civilization.

Hillmen could now travel freely. The natural salt springs, good tobacco climate, vast jungle resources of wild rubber, damar resin, and rattan vine encouraged them to become exporters and to buy the few things they lacked

'Storepedos' released over upper Baram, Sarawak, 1945

Belawit tableland, showing smoke signal for aircraft

—cattle, vases, cloth—from the lowlands. The process enlarged the outlook of isolated peoples, especially those like the Kelabits or Sabans, so isolated that no white man met one until over half a century after the first Rajah theoretically "governed" Sarawak.

Unfortunately the hill people paid their price not simply in salt, but equally in influenza, pneumonia, tuberculosis. The consequent depopulation in recent years led the people (especially Dutch Potoks) to turn increasingly towards Christianity, as energetically preached by several Malay missionaries. Those who have "become Christian" probably show an improvement in birth-rate and health since they adopted new rules of hygiene, abstinence and conduct. On the other hand, they tend to make duller fellows, sometimes to ape standards unnatural to themselves, and noticeably to indulge in petty theft, unknown among those still pagan.

The Japanese invasion had equally little *direct* effect on the Uplands. But it showed, first that the white man was no sort of unshakeable divinity, and then, later, that with all his faults he ran the country more for the benefit of its peoples than the yellow man could (or would).

In early 1945 the whites returned in all the glory of Liberator and parachute silk, to receive a tremendous ovation. Until then the hill people had no intimate knowledge of the white man's ideology except as interpreted (and somewhat distorted) by the few devoted missionaries. He had previously appeared as a sort of Halley's comet, occasionally whirling through the mountains, scattering needles, fishhooks, and hangovers. In the first months of 1945 the interior saw more white men than in all its past history. They dropped in, or later landed by Austercraft or Catalina. Many natives went to the coast for the first time—including sick who were flown out.

It was ironical enough that this return of the white man was to lead the now completely peaceful hill peoples back into the paths of pre-white headhunt and war. At first we had to rely largely on guerillas armed with native-made blowpipes, since we were operating so far from the nearest air base that we could not get sufficient other supplies. They were excellent weapons—light, silent, and deadly, since a wound may kill. With nearer air supply bases, we began to receive adequate rifles and automatic weapons, with which people soon became proficient. We also had, for the first time in the interior, adequate medical stores, an Australian doctor and two dressers, three Chinese dressers captured off the Japanese, and a first-class hospital supplied by air. Thousands of natives were employed in building an airfield; thousands more portering rice and ammunition; and several thousand fighting at distant points as soldiers. They can probably claim one of the finest records in the war—they killed more than one hundred Japanese for every guerilla lost.

It might be expected that these extraordinary changes in interior life would leave a deep mark on a people remote from civilization for untold centuries. Yet, when the war was over (we were fighting the Japanese in the uplands until November 1945), there was no fuss about closing down airfield or hospital. Within a couple of months it was difficult to realize that these mountains and plains had lately been seething with administrative and military activity, its repercussions reaching through Borneo to the sea on either side, with links as far away as the Philippines and Australia.

To-day the hill people are substantially carrying on where they left off. The war brought gains (particularly medical), but the lasting ones are that intangible widening of outlook and an attitude to the white man based on direct experience. Strange adventurers descended from the skies, several of them not the sort of men one would particularly choose as suitable for dealing with native people in ordinary times. But these Australians, some of whom tended to start off with a particularly violent colour-bar prejudice, adjusted themselves extraordinarily well. In fact, there is something about the hill people that reduces any white man to sympathy. And they on their side learned literally to love unassuming, able, and gallant soldiers like Sergeant F. Sanderson, D.C.M., and Dr. P. Henry, who operated their private army of Dayaks, Kelabits, and Tabuns on the Limbang; Lieutenant R. Pinkerton, M.C., who took Lawas with his Muruts; or Warrant-Officer J. Tredrea, M.M., who roamed Dutch Borneo with a hand-picked team of Potoks in remarkable adventure.

The war-time importance of the area has also overcome a good deal of the previous upland feeling of inferiority. With their particularly logical approach to life—less erratic and passive than the Malay, less superstitious and changeable than most river people—they should gain, in years to come, an increasing influence over affairs from which they have hitherto been excluded by the accidents of geography and by administrative neglect. In return, they will claim increasing educational, medical, and other services by which alone they can survive into the twenty-first century.

Borneo is *indivisible*. In guerilla war the only boundaries we could recognize were those of natural topography—the impassable ranges around Murud, for instance, or the frequently flooded Tutoh. For the first time interior natives themselves travelled any part of the interior freely to and fro, seeing it all, where previously one village had usually visited only the next few along the line. Every day and in many ways war demonstrated the advantage of treating the Uplands as a unity.

Something will have to be done in the future to reorientate Interior (and especially Upland) administration, and to establish effective liaison between the three administrations concerned. Even within Sarawak itself, the 4th and 5th Administrative Divisions cut the small "Kelabit country" in half, as well as putting an excessive strain on native cooperation, without rendering adequate service in return. One village has to travel for more than a month to pay taxes at Marudi on the Baram; another, two miles away, goes the other way to the lower Limbang, almost equally remote. Both journeys involve canoeing through country inhabited by alien and rather unfriendly people. None of the Kelabits have been administered from Lawas, a centre which most can reach entirely on foot—the method they prefer—through country inhabited by related Muruts.

In the past all three Borneo administrations have been too coastal-minded. The uplands certainly do present a problem for a white man who must have his whisky and soda at sundown. But because the people are fewer and farther away, that cannot in any sense reduce our responsibility. It is essential to eliminate not only the coastal-mindedness, but also a high degree of coastal domination. This is particularly marked on the Dutch side, where the Sultan

of Boelongan's territory[1] stretches inland to the Sarawak border. By a convenient dispensation of family rite, he is never permitted to go inland.

By and large, a new interior point of view is overdue. With it, the future of the Borneo Uplands and the adjacent lowland country of the interior can be pleasant, prosperous, and in accord both with the ethics of European and of pagan civilization. But if, for any reason, these are once more neglected, or if the three Governments concerned cannot work together on common problems, the 1945–46 story of unswerving loyalty, courage, commonsense, and sense of humour could become very different by 1956—in Borneo just as elsewhere in South-east Asia. No people could have served better or deserved better of white government than these illiterate, tough, cheerful, hard-drinking, dancing men and women of Central Borneo.

The preceding paper was read at the Evening Meeting of the Society on 6 January 1947.

DISCUSSION

Before the paper the PRESIDENT (The Rt. Hon. LORD RENNELL OF RODD) said: We are glad to have with us Mr. Tom Harrisson who is perhaps better known to you on other subjects than that with which he is to deal this evening. His study of native races owes its origin to the anthropological training he obtained during his early work in the Pacific. In 1934 he went to the New Hebrides and during the period he spent there he studied the native population by living with them. He had similar opportunities in Borneo of studying the natives with whom he lived and fought.

Mr. Harrisson then read his paper.

Colonel JOHN CHAPMAN-WALKER: I had the honour to command for about three years from its inception the rather fantastic and peculiar organization of whose operations those described by Mr. Harrisson formed part. My experience has been that people at home have no conception of the immense distances covered in the war against Japan. Consequently an extraordinary veil of secrecy was drawn over everything the Japanese were doing in and among the islands. We knew little about what was going on under the Japanese occupation in Borneo until we started clandestine operations there. No military intelligence was forthcoming from the usual sources except for air photographs which are not always helpful in jungle country. There was a certain amount of opposition to unorthodox operations of this nature, and it was largely due to the vision and foresight of that great Australian, General Blamey, that operations of this type came into being. About two years before there was any military landing in Borneo, Colonel Chester went in by submarine and Mr. Harrisson went in some eight or nine months later.

One very important military aspect of the guerilla operations was the extent to which they enabled us to deny food to the Japanese. The invasion of Borneo was the last series of operations carried out by the Australian Army, and the occupation was incomplete at the time the Japanese war came to an end. Thus the real importance of these operations never came to the notice of the public. They would however have been very important from the point of view of the British operations against Malaya, then in course of preparation, because the

[1] The name Boelongan is also applied to the Batang Kajang (=Kayan) river in Dutch Borneo. The township, also known as Tanjong Selor, includes the Sultan's tasteless palace and administrative buildings. It lies in the delta of the great river system that flows out opposite the Tarakan oil-field.

airfields in Balikpapan and Brunei Bay were nearer to Malaya than any land base which Admiral Lord Mountbatten had from the western approaches.

Apart from the strategic importance of the operation, Harrisson and the other leaders did establish in Borneo a greater degree of control and administration of the natives than had ever been established in the interior of Borneo before the war, or was ever likely to be established for many years to come. I ask you to realize the extraordinary courage of those who went into an enemy-occupied country by parachute, submarine, or flying-boat, at a time when almost nothing was known of the conditions or likely attitude of the native inhabitants.

Mr. WOODROW WYATT, M.P.: I want particularly to stress the point made by Mr. Tom Harrisson about the political aspects of the future of the hill tribes in Borneo. The Borneo hill tribes are very similar to those in Burma and even to the aboriginals of India where there are some thirty-five to forty million. Because they are not highly organized politically, nor vocal, I feel that they do not get the consideration from us that they deserve. When negotiations take place with the countries in which they live, normally we deal with those who have made the most headway in political activity and propaganda. The hill tribes live simply and they do not understand the complications of political life in the world outside. But when a major change is imminent in their country, they begin to react very sharply.

At the moment there are delegates on the way from Burma to this country to settle with the British Government the conditions upon which Burma will become independent. We ought to remember that out of the seventeen million population of Burma, there are some five or seven million hill peoples who in varying degrees dislike the delegates officially representing Burma. They would rather be under anyone's rule than that of the Burmese. During the Japanese occupation they remained loyal to the Allied cause, although it was not very obvious that they would have anything to gain from it. We must not forget their claim for consideration. Some provision must be made for their future, preferably leaving them with some degree of local autonomy.

Wing Commander E. A. SHACKLETON, M.P.: We have had an excellent tribute to the very great military achievements of Mr. Tom Harrisson and his colleagues. I should like to refer briefly to the geographical side of his work. In a much smaller way, during the Oxford University Sarawak Expedition of 1932, I had some experience of the sort of conditions of travel with which Harrisson had to contend during the many months he spent behind the Japanese lines and I should like to stress the immense difficulties he had to encounter. From the point of view of travel his was a most notable achievement. During his time in Sarawak he traversed a large part of relatively unknown territory, particularly up in the Kelabit country and across the frontier into Dutch Borneo, and he must have solved many of the geographical problems connected with it. Sometime I should like to hear his views on that fascinating and mysterious mountain Batu Lawi. I hope he will have an opportunity to follow up the work he has already done in Sarawak.

We were interested too to hear his views on the administration of Sarawak, which I personally am glad is now settled. Although I should like to pay tribute to the rule of the Brookes in Sarawak in the past, I think that the time has come when it should be an integral part of the British Commonwealth and Empire and receive all the advantages that it can have under the administration of the British Colonial Office.

The PRESIDENT: What impressed me most in listening to Mr. Harrisson was the capacity displayed by him to win the confidence of the people of the country at a time when our fortunes in war were at their lowest level. In spite of that, he secured their cooperation and achieved results which were not only beyond expectations, but almost miraculous.

THE SWEDISH DEEP SEA EXPEDITION

HANS PETTERSSON

THE SWEDISH EXPEDITION in the *Albatross*, of which I had the honour to give an account before a joint meeting of the Royal Society and the Royal Geographical Society, represents the first attack launched from Sweden on the problems of the deep ocean. During fifteen months (July 1947 to October 1948), new instruments and methods for investigating the depths of the ocean were used in the Atlantic, the Pacific and the Indian Oceans, mainly within or near their equatorial regions.[1] From the cruise the *Albatross* brought back about 250 sediment cores raised from great depths under the supervision of Dr. B. Kullenberg with his piston core-sampler [2]; more than 400 oscillograms and wire records of echoes from exploding depth-charges which will indicate, according to W. Weibull's method,[3] the thickness of the sediment carpet; more than 4000 water samples, some of them of great volume for uranium- and radium-determinations; and a still greater number of temperature measurements. In addition, observations have been made on submarine daylight in different spectral regions, including the ultra-violet, and on the rare particles suspended in deep water. The final cruise of four months in the Atlantic Ocean, as far south as the Equator and as far west as the Virgin Islands, afforded opportunities for deep-sea trawling also. A good catch of rare deep-sea fishes and invertebrate organisms were brought back by Dr. O. Nybelin who was in charge of the biological work.

This vast material is now being analysed in the Oceanografiska Institutet of Göteborg and in various other collaborating laboratories both in Sweden and abroad. It will be several years before this work is finished and the expedition report published. Already certain results are apparent, and seem worthy of notice.

Even at great depths, the profile of the sea-bottom (recorded along the ship's course by an ultrasonic echograph of great range made by the Marine Instruments Co. of London) is frequently rugged. The perfectly level bottom commonly assumed to exist at great depths is, according to our experience, rather the exception than the rule. Where such flat surfaces of considerable extent do occur in the Pacific and in the Indian Oceans, they are likely to be lava beds covered with a more or less thin superficial layer of sediment. Such occurrences of hard bottom repeatedly caused losses of coring tubes. Both in coring and in deep-sea trawling, as well as in echo-soundings of the sediment carpet, the ruggedness of the sea bottom was a serious complication.

Echoes from depth-charges exploding in depths between 500 and 6500 metres were recorded in all three oceans. The maximum depth of a reflecting

[1] See also *Geogr. J.* 110 (1947) 145–8.

[2] B. Kullenberg, "The piston core-sampler," *Sv. Hydr.-Biol. Komm. Skrifter*, Ser. 3 *Hydrografi*, vol. 1, Häfte 2 (1947).

[3] W. Weibull, "The thickness of ocean sediments measured by a reflexion method," *Medd. Oceanogr. Inst.*, 12 (1947).

layer below the sediment surface, recorded in the open Atlantic Ocean, approached 10,000 feet, whereas neither in the Pacific nor in the Indian Ocean was a thickness recorded much greater than 1000 feet. Whether these latter results are actually due to a smaller thickness of the deposits, or to intermediate lava beds obstructing the passage of the sound waves down to the underlying bed rock, it is difficult to decide.

Cores from apparently homogeneous red clay up to 45 feet long were raised, both from the Atlantic and the Pacific Oceans. In general however the long cores are stratified, especially those raised near the Equatorial Counter-Current. Cores from the Mediterranean, the Caribbean and the Sunda Seas display frequent layers of coarser grain, generally of volcanic ash. Both in the Mindanao Deep and in the Romanche Deep the corer was stopped by a layer of sand, coarse mineral fragments which limited the core-length to a few feet only. One core more than 40 feet long showing interesting stratification was however obtained from great depth (over 4100 fathoms) in the Romanche Deep. Organic detritus and humus, or both, were prominent components in the upper parts of the core just mentioned as well as in cores from the Gulf of Panama, from the Sunda Sea and also from the open Atlantic west of St. Paul's Rocks where a highly peculiar stratification was apparent. Signs of "slumping" and, possibly, of changes in level appeared where the slope of the sea bottom was considerable.

A rich haul of manganese concretions, some of them fairly large, was obtained to the south-east of the Bermudas in a depth of 3000 fathoms. A core of larger bore (4 inches in diameter instead of the ordinary 2 inches) taken in the vicinity had a manganese crust on top, covering a layer rich in ferric hydroxide.

When crossing the Equatorial Counter-Current diffuse reflexions were often observed on the echograms, appearing to come from some reflecting layer at a depth of 50 to 150 fathoms. In certain cases the echograms resembled those from fish shoals in northern waters, but attempts to catch the animals causing the reflexions were not successful.

In working up the material from the cruise special attention will be given to the chronological problem, where certain lines of attack appear promising.

Biological analysis of the Foraminifera shells indicates past changes in the temperature of the ocean surface, even in equatorial waters, probably caused by an alteration between cold (glacial) and warm (interglacial) epochs. Preliminary analyses of cores from the Mediterranean and from the Caribbean Sea have already been published by F. Phleger.[1] Other analyses, made on cores from the open Atlantic by W. Schott, are being prepared for publication. By these means a linking up of the chronology of the ocean floor with that of continental glaciology appears feasible.

Radioactive analysis affords another promising line of attack. The theory is that ionium, constantly precipitated from sea-water, gives rise to ionium-supported radium in the bottom deposits, the concentration decreasing down-

[1] F. Phleger, "Foraminifera of three submarine cores from the Tyrrhenian Sea," *Medd. Oceanogr. Inst.*, 13 (1947); "Foraminifera of a submarine core from the Caribbean Sea," *Medd. Oceanogr. Inst.*, 16 (1948).

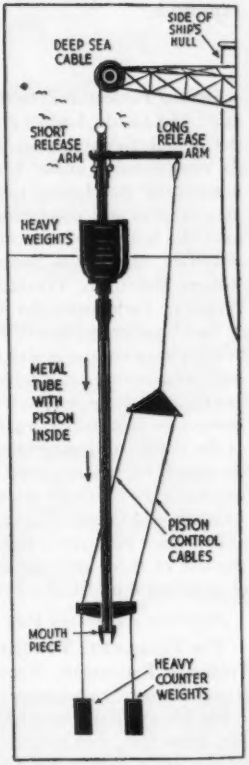
wards on account of its half-life period of 82,000 years.[1] Measurements on the content of uranium and of radium in large-volume water samples taken during the cruise, will prove useful for the analysis. An analysis of the rate of growth of manganese concretions from their content of radium (not supported by ionium) has already proved feasible.[2]

The mineralogical analysis of the cores, especially of the volcanic shards which some of them contain, may give clues to a relative chronology, especially in regions of extensive volcanic activity like the Mediterranean, the Caribbean and the Sunda Seas. Whether or not it will be possible to identify individual ash-layers with historic eruptions is an open question.

A magnetic analysis, by extracting the rare cosmic spherules of meteoritic origin from mid-ocean sediments with a very low rate of accumulation, may also perhaps afford clues to a relative chronology. Cores of wider bore giving much more material per unit length, have been taken from the *Albatross* for this special purpose.

Pollen analysis, used with such success in Scandinavia, may prove useful in limited areas, like the Tyrrhenian Sea,[3] near coasts or islands with a vegetation giving resistant pollen grains. In the hope of establishing a pollen analysis "key," borings in a peat bog on Nukuhiva were made during an excursion from the *Albatross*.

In general, the results already apparent from the expedition confirm the view that extensive investigations of the ocean bed are now possible by means of a technique more penetrating than that hitherto used. It is to be hoped that deep-sea research in the future, both oceanographical, geological and biological, may be taken up by an international organization like that established in the beginning of the present century for marine research in the shallower seas, the International Council for the Exploration of the Sea. The deep ocean with all its problems is a worthy field of cooperation between the sea-minded nations on both sides of the Atlantic Ocean.



The Kullenberg piston core-sampler

[1] H. Pettersson, "On the precipitation of ionium from sea-water," *Wiener Anzeiger*, 1 (1937).

[2] H. Pettersson, "Manganese nodules and the chronology of the ocean floor," *Medd. Oceanogr. Inst.* 6 (1943); "The geochronology of the deep ocean bed," *Tellus*, vol. 1, no. 1 (1949).

[3] C. Larsson, "Examination of pollen grains in three cores from the Tyrrhenian Sea," *Medd. Oceanogr. Inst.* 15 (1948) 73.

Professor Hans Pettersson, Director of the Swedish Oceanographical Institute at Göteborg, addressed a Joint Evening Meeting of the Royal Society and the Royal Geographical Society in the Society's Hall on 21 February 1949. Professor Pettersson has contributed the above summary of the scientific work of the expedition.

DISCUSSION

Before Professor Pettersson's address the PRESIDENT (Sir HARRY LINDSAY) said: My Lords, Ladies and Gentlemen, this is a very special meeting, in that the Royal Geographical Society is meeting jointly with the Royal Society. As you probably know, Lord Rennell, my predecessor, and I have always been desirous of developing joint meetings with other Societies concerned with us in a similar and congenial range of subjects. We are extremely fortunate to have the honour of associating with this meeting the parent of all the Learned Societies, the Royal Society. We welcome particularly on this occasion Sir Robert Robinson, President of the Royal Society. We welcome, with him, Professor Pettersson, the distinguished Swedish scientist, who is to address us.

Professor Pettersson is the Director of the Swedish Oceanographical Institute at Göteborg and he is also the son of an equally distinguished Swedish scientist and oceanographer. Professor Pettersson is no newcomer to the Royal Geographical Society, for, as most of those present will remember, he addressed the Society in November, 1946, on the subject of his explorations on the sea-beds of the Western Mediterranean. Since then he has further developed the methods by which he has acquired fame and has explored still deeper ocean-beds. He has recently returned from leading an expedition which covered parts of the Atlantic and Pacific Oceans, and I believe the Indian Ocean also.

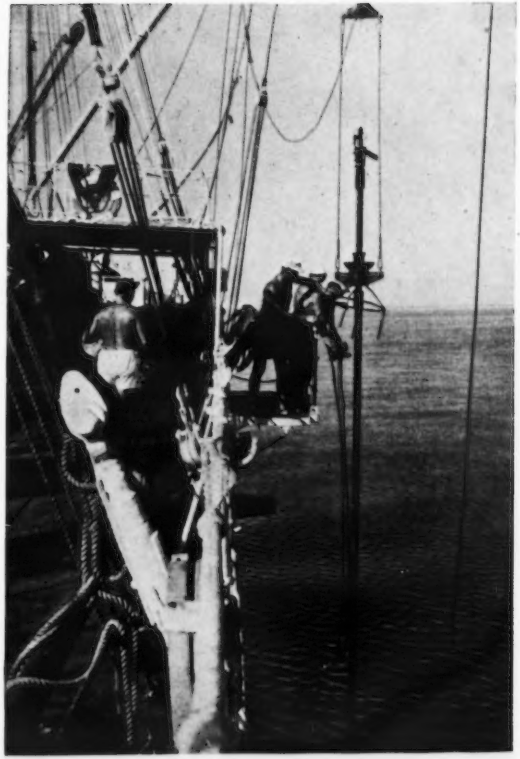
Professor Pettersson has evolved certain new techniques and it is the story of the use of these techniques and the remarkable results they have achieved in elucidating the history of the ocean-bed that we shall hear from him now.

Professor Pettersson then addressed the Society.

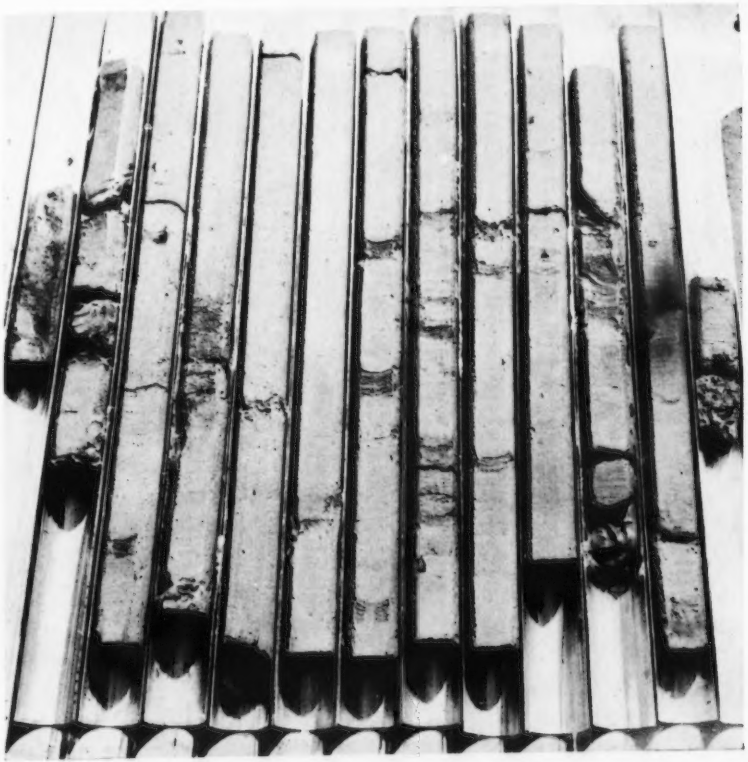
The PRESIDENT: You have delivered a most interesting and inspiring lecture, Professor Pettersson. Now may I ask Sir Robert Robinson, President of the Royal Society, to address the meeting.

Sir ROBERT ROBINSON: May I say in the first place how grateful we are to you, Mr. President, and to your predecessor, Lord Rennell, for having invited us to take part in this quite historic occasion on which we have heard Professor Pettersson give an account of his explorations. We are grateful also to him for his generous references to the part the Royal Society played in promoting the *Challenger* expedition. The success of the *Albatross* expedition was certainly due to excellent planning and to the generous support and encouragement which those who took part in it received; yet its success was due above all to the personality of Professor Pettersson himself, whose great humanity, humour and inspiration kept the whole organization in harmony throughout the long voyage.

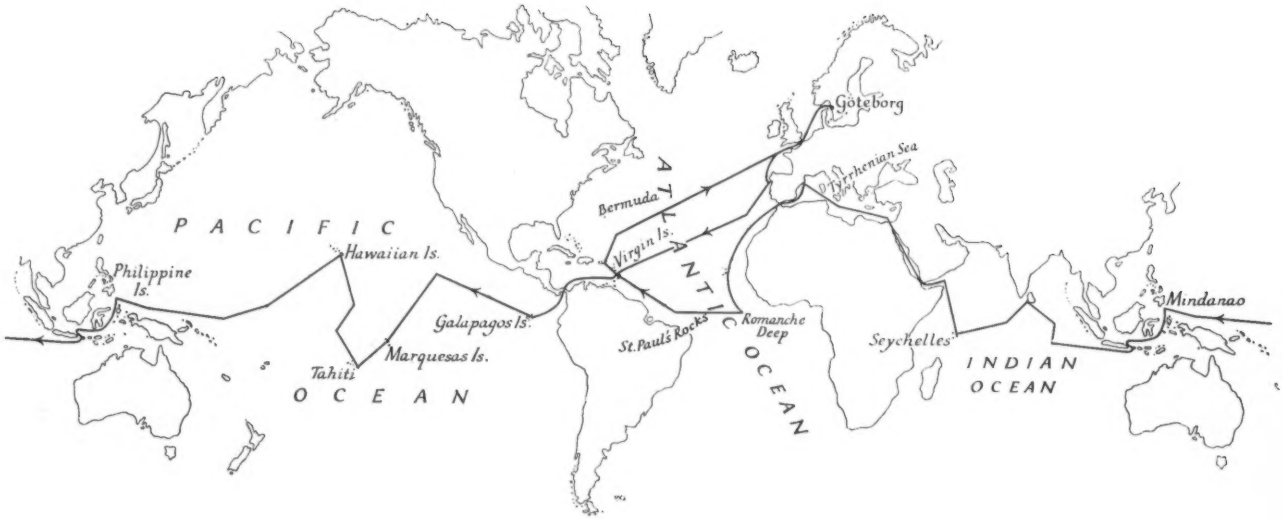
As to the results, we were very proud to have Professor Pettersson give a lecture before the Royal Society in 1946 when he described his plan of operation and we have had the opportunity of seeing the *Albatross* at the end of her voyage. To-night he has told us of what has actually been accomplished and it proves to be rather more than even he had originally thought possible; and now he is faced with the enormous task, as he has said, of going through the data provided by the cores and records of all kinds. That will naturally take a great deal of time. I gathered from a little hint dropped towards the end of



Lowering the piston core sampler



A long core from the Tyrrhenian Sea showing Vesuvian ash zones



The track of the Albatross

the lecture that Professor Pettersson contemplates yet another expedition, but I hope it will not be undetaken before he has had time to digest the results of the first. I was particularly interested by the way in which the habits of the foraminifera can be used to date the cores and provide a time scale. Perhaps Professor Pettersson will tell us whether the earlier method based on radioactivity has been used as a control on this more biological method.

May I heartily congratulate your son, through you Professor Pettersson, on the Kodachrome photographs which gave given us such a vivid idea of the colourful regions you traversed.

In conclusion, I wish to reiterate, on behalf of the Royal Society, how pleased we are to join with the Royal Geographical Society in this meeting. We wish to thank Professor Pettersson for a most inspiring and interesting lecture and to congratulate him, with his colleagues, on a very notable achievement.

Professor O. T. Jones (Professor of Geology, Cambridge): To say that I have been fascinated by Professor Pettersson's lecture is an under-statement. It opens up a new era in submarine exploration. I was most interested about two years ago to hear Professor Pettersson describe his apparatus for the first time and to listen to the results he had obtained in the preliminary explorations in the Western Mediterranean. It seems to me he has a weapon which, when fully developed and used, is capable of throwing a completely new light upon a subject which at present is obscure; in other words, the constitution and history of the great ocean floors.

There were various points which impressed me very much and I am sure that there were many results which surprised even Professor Pettersson; especially to find, in so many areas, for instance, that practically hard rock formed the ocean floor. As a result of that, he suffered considerable losses in instruments. One suspects, and one tells students from time to time, that volcanic eruptions can take place on the ocean floor, with the suggestion that perhaps that might occur once in a while over limited areas. Evidently however it is a phenomenon on a far wider scale, and the fact that Professor Pettersson found many such areas of rough bottom which he interprets, I think correctly, as recent volcanic flows is of great interest. It might be possible to avoid losing instruments by the adoption of the old-fashioned method of sounding. If the old lead with tallow on the bottom were lowered on to the sea floor, a hard bottom would probably be recorded and some other place could be chosen in which to take a core sample.

Among the curious points mentioned, one was in regard to the dark part of the core which was exhibited on the diagrams on the wall. Professor Pettersson described this as containing sand, and he referred to similar beds of sand, surprisingly enough, at a comparatively shallow depth below the surface of the deposits on the floor of the ocean. He found these beds of coarse-grained material, which he described as sand beneath a great depth of ocean. That is almost incredible, and yet there is the record of it in the diagram. How did those coarse-grained materials get down to those depths of ocean floor? I can only think of one explanation, and I am not very hopeful of that, namely, that these sands have slid on the surface of the oceans deposits and down the slopes from shallow water—perhaps a considerable distance away. It might be interesting therefore to inquire as to the material of which those sands are composed. Sands are peculiar materials; they are fairly solid at times and quick at other times, and when they become quick they will flow for a great distance on very gentle slopes. It is just conceivable therefore that the sands found at these great depths may have travelled a great distance from the area in which those coarse-grained deposits were formed.

Professor Pettersson also mentioned, and it interested me greatly, the effect of echoes from somewhere in the middle of the sea at depths which varied from time to time. I was reminded of a report published recently in regard to the North Pacific Ocean, where some American workers, using echo-sounding apparatus, found similar reflections not from the floor but from some intermediate depth and, curiously, from a depth that varied with the time of day. They began to suspect some organic reason for that and ultimately found those reflections were from vast shoals of so-called "pink feed," a species of shrimp found in the North Pacific, which occurred in enormous numbers in those particular areas. They were so dense that they gave perfectly good echoes from the echo-sounding apparatus.

I can only hope that the results which have been obtained will appear without too great delay. I know how difficult it is to get perhaps ten or more workers to sit down and get on with the job so as to get it done within a reasonable time. I hope therefore that Professor Pettersson will use a very firm hand and that the results will appear before he goes on another expedition. If that is not done we shall have another batch of observations similar to these and there is no knowing when we shall have the pleasure of reading about them.

I add, in conclusion, my sincere congratulations to Professor Pettersson on his magnificent achievement.

The PRESIDENT: The Society is greatly honoured by the fact that His Excellency the Swedish Ambassador is with us this evening. It is not quite fair, perhaps, to call upon him because I have not previously given His Excellency notice, but we should be glad if he would address the meeting.

H.E. THE SWEDISH AMBASSADOR: It is certainly a great honour for me to have been present and to listen to the lecture by my compatriot, Professor Pettersson. I have found his lecture most entertaining, if I may use such a word, and not only entertaining; it has set me dreaming and, in a sense, comforting myself. A year ago I was in the United States and I heard of a rich American who had given a large sum of money towards the Observatory in Berkeley, California. The professor at the head of the Observatory was invited to dinner by the generous benefactor and during the meal the conversation turned only upon the question of the local elections. After dinner, the Professor asked the benefactor to visit the Observatory and to take a look at the stars. On the Professor remarking that a certain star was about 2000 years distant, the American business-man looked at him and said: "When you tell me all this, the result of the local elections is not so important as I thought." When Professor Pettersson spoke of 300 million years and 3 million years, I had somewhat the same feeling. In the midst of all sorts of complicated day-to-day affairs it is a comfort to listen to such a lecture. To me at least it has opened up a great vista of certain of our earthly problems.

Mr. President, may I also thank you for having given this opportunity to Swedish scientists to be present at this important gathering. We recognize and are very proud of the fact that Swedish science has been most generously treated by your famous Society.

The PRESIDENT: You have, ladies and gentlemen, heard our three chief guests express their very hearty appreciation of Professor Pettersson's extremely inspiring lecture. May I ask you to join in a very hearty vote of thanks to him.

THE SHOAN PLATEAU AND ITS PEOPLE: AN ESSAY IN LOCAL GEOGRAPHY

D. R. BUXTON

DURING THE FIFTEEN months from October 1946 to January 1948, I was working in an educational centre near Debra Berhan, an important market town and district headquarters 80 miles north-east of Addis Ababa on the Asmara road. The district was historically interesting as the hub of the old kingdom of Shoa, and it was still an important centre of Amhara population. Moreover I soon found that it contained some very remarkable topographical features. I therefore decided to devote my leisure to a detailed study of the area, which I expected to help in my educational work and also to furnish (as such studies had never, as far as I knew, been made in Ethiopia) material of some geographical interest and novelty. Unfortunately I had to leave the district before finishing what I had intended to do. But I was able to complete a large-scale compass-survey covering about a hundred square miles, working out from the village of Tebasse where I lived. This paper deals chiefly with the area shown on the map, and its Amhara population. Something will be said of the traditional ways of these people, but the formidable problems of the present day are left out of account.

The map was made, on the scale of 1: 50,000, entirely by triangulation with the prismatic compass based on points along a 5-mile section of the Italian motor-road, which runs in straight lines and is conveniently marked out with stones at 50-metre intervals. The first stage was to cover the area with a sufficient number of principal fixed points, which were mostly conspicuous trees and hill-tops. The second stage, which occupied the week-end walks of nearly twelve months, was to follow all the principal mule-tracks and streams, and all the edges of the gorges, fixing points at intervals by resection; at the same time I tried to fix all the churches accurately, but a few were missed. A comprehensive framework was thus built up, all plotting being done at home. Finally I walked all over the area again, taking with me tracings of the framework on which the remaining detail required—hill-slopes, habitations, etc.—was inserted by eye. The method gave most satisfactory results, for the area was small (only about ten miles by eleven) and the base-line relatively very long. The only serious difficulty—bewildering until I realized its cause—was the falsification of compass readings (occasionally by as much as 15°) by magnetic rocks. One could sometimes avoid this by climbing into a tree, but bearings simply could not be taken from some points which would otherwise have been most useful.

To indicate relief I decided to use hachures rather than form-lines, real contouring being out of the question with the means, and in the time, at my disposal. The hachures seem to me to give a true impression to the eye of the peculiar character of this piece of country, for they bring out the contrast between the relatively slight relief of the plateau and the sudden, sensational depths of the cliff-bound gorges.

The fragment of country depicted by the map lies on the edge of an important section of the Shoan plateau which extends in the form of an elongated oval north-eastwards from Addis Ababa and forms the watershed between the drainage systems of the Awash and the Blue Nile. The Asmara road uses this convenient high causeway from Addis Ababa to a little beyond Debra Berhan, and would go on using it if this were possible, for the road was made to follow the plateau wherever it was flat enough. North of Debra Berhan, however, the country is tremendously cut up by deep ravines and no level plateau remains. The road is therefore forced down, at Debra Sina, to lower levels (as happens again in several places on the way to Asmara). The higher portions of this plateau lie at well over 9000 feet and constitute an undulating tract, sometimes almost flat, sometimes rather hilly, where differences in level amount to a few hundred feet only. But, on both sides, the plateau breaks up in the most spectacular fashion. To the north-west lie a series of gorges, all belonging to the Blue Nile system, opening up with extreme abruptness along an irregular front, as will be seen in the map. To the east, the plateau terminates in some places at the main escarpment which bounds the Danakil plains, an impressive drop of several thousand feet along a fault, well seen at Ankober and Debra Sina. But farther south the simplicity of this escarpment is disguised by certain tributaries of the Hawash system which, eating their way into the plateau, have formed gorges as striking as those of the Blue Nile system. These gorges, cutting back continually, must in time complete the destruction of the plateau, and produce, by the interdigitation of their deeply entrenched headstreams, the confused type of scenery already observable farther north.

The geological structure of the plateau, on which the local landscape, and especially the peculiar type of gorge developed, directly depends, seems to be extremely simple and almost the same as that which occurs over vast areas of central and northern Ethiopia. As long ago as 1870 the step-like hill sides and tremendous gorges of the Magdala area were well described by Blanford,[1] who had accompanied the Napier Expedition. He compared Abyssinian scenery with that of the western Deccan and the Western Ghats of India, but remarked that in the case of Abyssinia the special features of this type of landscape were exaggerated. He drew attention to the hill-forts or "ambas" of Abyssinia, closely corresponding to features which had likewise been used in India as forts.

Writing of the Jitta gorge near Magdala, Blanford says:

> ". . . we came suddenly on the brink of the mighty chasm in which the Jitta river runs, and to which all the minor valleys converge. Of all the grand scenery met with in Abyssinia, none equalled this wonderful gorge. It is 3500 feet deep, and looks scarcely a mile across. The sides are extremely steep, in places nearly perpendicular. The horizontal beds on both sides appear to correspond exactly; half-way down there is a well-marked terrace, evidently formed by the same bed, on both sides of the river. The bedding is very distinct.
>
> It is to be regretted that all those geologists who disbelieve in the power

[1] Blanford, 'The Geology and Zoology of Abyssinia,' p. 86, London, 1870.

Gorges of the Kassam river from the Shoan plateau

The head of the Chacha gorge

Basalt cliffs, Chacha gorge

of running water, and appeal to such *Dei ex machina* as marine action and waves of translation, cannot see a few such marks of the handiwork of rain and rivers as are shown by these gorges. There is not the slightest possibility, as far as I can see, of explaining their origin by any other force than that of the streams flowing in them. Any faulting or dislocation of the rocks is out of the question, there is no evidence of glacier action at any past time, and even the most fervent apostle of marine denudation would scarcely credit it with the formation of a Titanic trench three-quarters of a mile deep and very little more in breadth."

This description would apply equally to the gorges found in other parts of the Ethiopian highlands, for they are all, as far as I have seen, remarkably similar; and no geologist would now question their formation by stream erosion.

The formations of Blanford's area were called by him the Magdala group of "Traps"—an enormously thick, practically horizontal layer of lava flows. They were especially characterized by bands of trachyte, often columnar, weathering to form steep scarps. These formations are probably of late- or post-Cretaceous age, since Blanford's Ashangi Traps (upon which the Magdala group lies unconformably) were tentatively attributed by him to the Upper Cretaceous. Referring to the Magdala Traps Blanford says: "It is highly probable that the Trap rocks of Shoa belong, in part at least, to this group", his belief being based on some descriptions of Rocher d'Hericourt, who travelled in Shoa in the 1840's. My own limited observations confirm this assumption, except that in our area the most conspicuous cliffs and scarps consisted of columnar basalt, not trachyte. The area shown on the map consists of alternating harder and softer layers of volcanic rocks, including basalts, trachytes and tuffs (the latter often used, as in Kenya, for building). They dip slightly to the north-west.

The plateau, which occupies most of the sheet, lies everywhere above 9000 feet. It enjoys a temperate climate, and frosts are not uncommon in December and January. It is swept by easterly winds throughout the year, except when rain is actually threatened or falling, when it commonly turns right round to the west—a frequent occurrence during the long rainy season (June to September). The volcanic rocks have given rise to deep and potentially very fertile soils. The high plateau is mostly short grassland with very little bush, except in places protected both from wind and grazing animals, and very few trees except for small clumps of introduced Eucalyptus which mark almost every inhabited place. Owing to the scarcity of timber a dung-fuel known as *kubat* is usually burnt. At first sight the plateau appears very thinly populated but this, as will be shown, is an illusion. Anything like a village is rare, but isolated homesteads occur almost everywhere on rising ground. Nearly all this country makes good grazing for cattle, sheep and goats, and it is high enough for horses to flourish. Perhaps a third of it is more or less cultivable, though the area under cultivation in any one year is much less. Owing to cold and exposure very few crops flourish on the plateau itself, the principal ones being barley and broad beans.

The natural flora of the high plateau is not rich, though in rocky, sheltered spots a succession of attractive herbs and shrubs, including Jasmine, a yellow

Buddleia, a large St. John's Wort and a handsome red Aloe, comes out in the course of the year. There is a very striking giant thistle (*Echinops*). During the rains lilies, orchids, and red-hot-pokers (*Kniphofia*) come up in plenty. Many typically temperate genera occur in the mountain grasslands, examples being a low-growing wild rose, ladies' mantle (*Alchemilla*) and mullein (*Verbascum*).

The lower plateau, which is the more extensive part and the only type of country seen from the motor road, is comparatively flat and therefore has naturally been traversed at all times by the main routes between north and south. The streams meander through broad, shallow valleys which, being swampy and almost impassable in the rains, are uninhabited, but much used for grazing. The main streams, following the dip of the lava beds, flow north-west. Well-marked tributaries are few, and after heavy rain the water simply drains away over the general surface. Here and there are small secondary plateaus, standing two to three hundred feet above the general level; their slopes where not too steep are well populated and their flat tops largely under cultivation. Good examples are the village areas of Fajji and Aloberet shown on the map. These small plateaus, as well as all the edges of gorges in the north-west corner of the sheet, are capped with a very hard layer of basalt which (as I found to my great annoyance when making the compass survey) contains an abundance of magnetic iron. A hundred years ago, as several travellers have recorded, these rocks were used for iron-smelting, but the industry has long since been abandoned.

As we follow the streams upwards into the higher part of the plateau the character of the country changes. The broad plains narrow down and disappear, and the streams, more recently entrenched, flow in narrow valleys and little ravines; some of them might be thought quite striking if it were not for the severe standard of comparison afforded by the huge gorges below. The country is broken up into hills, usually steep-sided and flat-topped, and rocky hogsbacks. This kind of country is to be seen in the south-east corner of the sheet. The most interesting feature here is the wedge of country left standing up between the Beressa river and its large tributary the Maka. It has been cut away sharply on either side and forms, in its narrower part, a high ridge between the valleys. One of the highest points was appropriated long ago for a fort (near the village of Dilila) and was again used as such, by both parties at different times, during the Italian régime. The other high point (a prominent hill farther to the south-east, near the edge of the sheet) has recently been crowned with a church dedicated to the archangel Gabriel.

The third and most interesting type of country is that of the gorges, which cut into the almost level plateau with such remarkable abruptness that they resemble scoopings in a lump of cheese made with a sharp-edged gouge. At the head of each gorge the streams form a series of falls, or in some cases a single big fall of 400 feet or so; even higher falls, up to 600 feet, can be seen elsewhere. Everywhere the upper walls of the gorges, which are basaltic, fall precipitously, and often form vertical cliffs several hundred feet high. So sharply defined are these gorge-edges that a heedless person walking on the plateau might, in some places, fall over them into the abyss. The walls do not however drop away continuously to the stream at the bottom; at a certain level, or in some valleys at more than one level, a horizontal shelf is

Artificial terraces and natural shelves, Dalecha gorge

Shelves at two levels, Chacha gorge

In the Beressa gorge, a densely populated shelf below basalt cliffs

developed. I was interested to find, when first exploring this piece of country, that the shelves were well populated, intensively cultivated, and provided with a quite surprising number of churches; facts, as pointed out below, of some historical significance.

After completing the framework of the map I made several calculations of depth in the Beressa gorge. An Abney level was used and as high angles were involved I think the results are trustworthy. They showed a depth of 1808 feet at the point marked *a*, just under 3 miles from the head of the gorge; 1985 feet at point *b*, 4 miles down; and 2170 feet at *c*, not quite 6 miles down. The average gradient from *a* to *b* was therefore about 2^1_4 per cent., from *b* to *c* about 2 per cent. The depths were measured from three points (marked 1–3), all at practically the same level, on the edge of the gorge, the height of which can be taken as about 9300 feet. The absolute level of point *c* is therefore about 7130 feet, and this is almost the lowest point on the sheet. Measurements show that the depth of this gorge, enormously impressive though it is, is not more than one-fifth of its breadth. Although relatively deeper ones no doubt exist, I cannot help being highly sceptical of Rocher d'Hericourt's report of a ravine "14 leagues north-west of Angolala" which he alleged to be 1254 metres deep and only 800 broad!

Four separate gorges figure on the map. The two middle ones, formed by the Beressa and Dalecha rivers, which enclose between them the cliff-encircled plateau of Choli, can be seen to join within 4 to 5 miles of Debra Berhan. It might be supposed that the other two gorges were destined to join the same system within a short distance, but this does not happen. If the small-scale Italian map is to be trusted, the Gunagunit (north-east corner of the sheet) joins the Beressa system some 20 miles away, and the Chacha (of which the north-western gorge is a tributary) nearly 30 miles away. These junctions are approximately north of Debra Berhan; afterwards the river bends away north-westwards to join a main tributary of the Blue Nile. As might be expected, these independent gorge-systems running approximately parallel to each other proved most confusing. Between the adjacent systems one sees long, narrow strips of residual plateau, perfectly flat-topped, sometimes so narrow as to stand up like a wall between one valley and the next. The Tallak Amba plateau, partly shown in the north-west of the sheet, is an example. On the other side of the sheet a still narrower neck, followed by the Tegulet path, separates the Beressa and Gunagunit systems. Following this route to the north, off the sheet, one finds that for some distance the plateau has been cut right away: one descends about 600 feet to a point where the shelves in two adjacent valleys practically coalesce, being separated only by a rocky barrier a few feet high. Then one climbs again to a narrow slip of plateau on whose summit, flat as a table-top, stands an important church (Zendegur Ghiorghis). Still farther north this narrows down to a sinuous rampart between the valleys, and eventually broadens once more to form a substantial isolated plateau, which appeared in the distance to be almost inaccessible. Another remarkable feature, jutting out between the Dalecha and the small tributary which next joins the Beressa, is shown near the northern border of the sheet and will be described later.

This region is the heart of the old Shoan kingdom and many places included

on the sheet, or not far from it, have historical associations. Tegulet, a little to the north, was the home country of Yikuno Amlak, the Shoan prince in whose person the Solomonian line was restored to the throne of Ethiopia in the thirteenth century. Debra Berhan itself, now a rather sordid settlement on the Asmara road, is of ancient foundation, for the emperor Zar'a Yakob made it his capital in the fifteenth century. Although a somewhat cold and inhospitable place it has an obvious advantage as commanding what must always have been an important focus of routes. Even in modern times it was inevitable that the Asmara road should be brought through this easy passage, avoiding the impassable gorges on the one hand and the much broken country of the higher plateau on the other.

Although there is no proof, and apparently no relevant tradition, I should be inclined to attribute to Zar'a Yakob some curious caves excavated in one end of a high hogsback 2 miles south-east of Debra Berhan. Unfortunately I inspected them only once and rather casually and found no opportunity to come again. There are at least two very elaborate excavations, besides some rougher ones, now partly inhabited. The two principal caves are very similar in lay-out. Entering by a roughly rounded lobby, one passes through a small hole in the rock, which admits scarcely any daylight, into the principal interior space. This is approximately circular and perhaps 25 feet in diameter. On the far side, opposite the entrance, it communicates with a smaller chamber semi-circular in form. From the main space a passage leads off, in the first cave to the right, in the second to the left; these receive no daylight at all. In the first cave the passage (which was half under water) turned twice to the right and was thus bent back on itself. It opened into several miniature cells, in shape an erect oval and only big enough for a man to stand in, each of which appeared to have opened through a small hole at the top into an upper space of some kind. The passage belonging to the second cave had basin-shaped excavations in its floor opening through small holes into spaces below. I therefore conjectured that I had here got into an upper passage such as apparently existed above the other system. Possibly these were underground chapels inspired by rock-excavated churches of the Lalibela school. As to the passages and the small spaces leading off them, with what seemed to be their ventilating arrangements, they might have been stores of some kind, or burial chambers, or special places of devotion, or hermits' cells—but these are speculations. If the mud which chokes these caves were removed something definite might be found out about them. They found a use quite recently, for at the time of the Italian invasion *tabots* and other church valuables were said to have been hidden in them.

In the first half of the sixteenth century the Shoan plateau, in common with a large part of Ethiopia, was occupied by Galla tribes invading from the south. These Gallas were essentially horsemen and herdsmen, and it seems that, while they occupied the entire plateau, they did not seriously attempt to penetrate the gorges, into which even a mule descends with difficulty. I believe that the Amhara population became forcibly concentrated in the upper reaches of the gorges at this time, and that the dense population which resulted explains the extraordinary number of churches which came to be built there. Even to-day the greater part of the plateau between Addis

Ababa and Debra Berhan remains Galla country. The Amharas have re-occupied the region immediately around Debra Berhan, their southern limit corresponding roughly with the edge of the sheet; but the churches built to meet their needs (including the new St. Gabriel already once mentioned) are comparatively few and far between, a confirmation of the recent date of the re-colonization.

The Gallas remained in possession of the plateau country until the early nineteenth century when Sahele Selassie, king of Shoa, began to push them back. The half-dozen hill-top forts shown on the sheet almost certainly date from this time, or were reoccupied then. The capital of Shoa since the eighteenth century had been Ankober, on the edge of the great eastern escarpment, some 20 miles east of Debra Berhan. But Sahele Selassie, as part of his anti-Galla campaign founded, in about 1830, a new capital at Angolala in the midst of Galla country. He thereafter divided his time between Angolala and Ankober. A largely disused track, still well-defined in most parts, is shown crossing the sheet from Angolala in an easterly direction; this was evidently an old route joining the two capitals. Harris,[1] who conducted a British Mission to Sahele Selassie in 1841–42, visited Angolala which then contained four or five hundred huts. He also describes Sahele Selassie's two-storied "palace," built by an Albanian[2] visitor, standing on an eminence—which however the king would not inhabit, from fear of earthquakes. Angolala continued to be used by Sahele Selassie's son, king Haile Malakot, and the great Menelik, who was Haile Malakot's son, had been born here in 1843—just after the time of Harris's visit.

Not much remains now to show that Angolala was so recently the twin capital of Shoa; but the site of Sahele Salassie's house, an artificial mound crowning the ridge, is easily identified and commands a fine view of the countryside. Inside the mound is a vaulted cellar, its masonry showing clear signs of European workmanship, as also does the central stone-built element of the local church of Kidane Meheret. This work is now exposed to view as the church was burnt down during the Italian occupation. Angolala remains a well-populated area, but only a very few huts now stand among the remains of defensive walls near the old royal residence.

The young Menelik, up to the age of twelve, must have known all this country well. But at that time (1855) the newly crowned emperor Theodore, whose ambition was the unification of Ethiopia after a century and a half of anarchy and internal strife, came down from the north with the object of subjecting Shoa to his personal rule. He defeated king Haile Malakot on the plains of Atakilt, the irrigated area just south-east of Debra Berhan. Haile Malakot died immediately after the battle, and Menelik was carried away captive by Theodore—who, however, afterwards treated him as a son rather than a prisoner. For some years Menelik followed in the emperor's train, moving with him from Gondar to Debra Tabor and then to the hill-fortress of Magdala, Theodore's last capital and later the scene of his undoing. Several years before Napier's siege of 1868 Menelik had escaped from Magdala during, it is said, one of Theodore's periodic orgies. A youth in

[1] Harris, 'The Highlands of Aethiopia,' London, 1844.

[2] It is much more likely that Harris meant an Armenian.

his early twenties, he found his way back to Ankober and assumed his rights as king of Shoa.

Menelik, who was a restless and imaginative character as well as a great soldier, soon began the series of vast conquests in the southern Galla lands which were to double the size of Ethiopia. It is therefore not surprising that he should have abandoned Ankober in favour of a capital within easier reach of his newly acquired territories. He first reverted to Debra Berhan, then made a new temporary capital at Liché, a few miles to the north-east. Here, at one end of a long, low hill are various remains of massive dry-stone walls as at Angolala, and the raised platform, only about 20 feet across, on which stood Menelik's personal dwelling. But the site is now uninhabited. In the 1880's Menelik, his southern conquests rapidly extending, moved his capital south-westwards to Entotto, in the midst of country newly retrieved from the Gallas. This was a magnificent site, 10,000 feet high and overlooking the plain and the splendid circle of mountains which form the setting of the present capital. Entotto was, however, unsuitable as the site of a permanent city. It is said, also, that Menelik's wife Taitu craved for a warmer residence and especially for the curative waters of the hot springs (the present Fil Wuha baths) on the edge of the plain below. So in 1889, the year in which he was crowned emperor in succession to John IV, Menelik moved down, and Addis Ababa was founded at the foot of the hills, 1500 feet below.

This digression completes our brief review of the historical associations of the area represented on the map. The remainder of this paper will deal with the present inhabitants, their distribution and their way of life.

It has already been said that the population of the area is greater than at first sight appears. The small, stone-built huts are inconspicuous objects, especially as they are seldom massed together to form a village but are widely scattered in small groups. Moreover the motor-road follows for the most part an exposed tract which carries less than the normal population. Travellers driving through therefore carry away a false impression: they can see little of the more populated areas, nothing of the gorges, and not a single one of the numerous churches of the region, except those of Debra Berhan itself.

I attempted to mark every inhabited place on the map. In very many cases the single dot indicates several households, and may be taken to represent, on an average, two households of five to six persons each or eleven souls. On this basis the population of the whole area of 102 square miles comes to about 15,500 or 152 per square mile—a high average by African standards. (This excludes Debra Berhan itself which would add a further 2000 or so.) The population is not, however, evenly distributed, and the area may be divided into three parts which, with their areas and population densities (again ignoring Debra Berhan) are as follows:

General plateau: 60 square miles—116 per square mile.

Plateau between or within 1 km. of gorges: 22 square miles—240 per square mile.

The gorges themselves: 20 square miles—162 per square mile. (This indicates a very high concentration on the "shelves" and a few other favoured spots, for a great part of the gorge area is, of course, uninhabitable.)

These figures show that the gorges, together with the adjoining and intervening plateau, carry a considerably higher population than the rest of the plateau, the combined average being over 200 per square mile. The figures for population per church are also interesting. The gorges and the adjacent parts of the plateau contain no fewer than thirteen churches and they serve an average population of only some 650 souls each. On the other hand the churches of the general plateau, not counting those of Debra Berhan, which chiefly serve the townspeople, number only four. They must cater for about three times as many people each, and until recently many more for two of them are recent foundations.

The higher population of the gorge region is attributable to two causes: the greater productivity of the land there, and the historical fact, already referred to, that the Amharas were long forced to live in the gorges, and have re-emerged only in recent times. This is confirmed by the evidence of the churches which, in such numbers, are sure evidence of a long-established Christian population. The oldest ones are among those in the depths of the gorges; sites on the edges of gorges seem to be more recent. The few plateau churches are all relatively modern and bespeak the re-occupation by Amharas; two of them were indeed founded within the last fifteen years, and one as recently as 1945.

As can be seen from the map, sites chosen for dwellings are usually on the higher ground. The favourite sites, of which many examples can be seen on the sheet, are rocky ridges and the tops or upper slopes of hills and minor plateaus. A high place with an outlook, together with reasonable proximity to permanent water, seem to be the conditions sought after. Even the most elevated and exposed hill-tops are generally inhabited, whereas nobody tries to live on the plains near the main streams, which become very swampy in the rains. The ordinary family, together with its domestic animals, lives in a small, irregular cluster of round huts, which in this area are built of stone cemented with mud and carry a conical thatched roof. They are surrounded, as a rule, by a dry-stone wall, which may be shared by several households. Richer people may have an ornamental gatehouse at the main entry, with a little watchman's room over the gate; but such ostentation was not common.

Disregarding some of the Debra Berhan people, almost the entire population is engaged in farming which, here as elsewhere in Ethiopia, is the mainstay of existence. Some possess their own land; others hold their plots, in return for a proportion of the produce (but without any security of tenure), from absentee landowners. There is also a landless element, greatly increased through the disturbing influence of the Italian occupation, who hire themselves out as ploughmen and labourers. I had intended to measure some typical holdings in order to estimate the area actually required to support a family, but my time in the area was cut short and I never did so. As a very rough estimate I think that about 15–20 per cent. of the area is under cultivation in any one year, which would indicate an average per family of something like 4 acres. This does not include fallow land which, once re-grown with grass, cannot be distinguished at a glance from permanent pasture.

The most exposed parts of the plateau near Debra Berhan will grow two crops only, barley and broad beans, but a limited amount of wheat (a bearded

variety) and linseed is grown in most parts of it. Where more shelter exists lentils and chick-pea are also planted, and another low-growing leguminous crop called *gwayo*, which is used only as a cattle fodder as it is believed to cause softening of the bones in man! The barley is planted early and the other crops late in the main rainy season (June–September). Barley is sometimes also planted in the early rains, which are very uncertain here but usually begin in February or March. In this area however the early crop rarely gives a good return and sometimes fails completely. The plateau land, after being cultivated for a few years (often until it shows obvious signs of exhaustion), is fallowed for a period which varies widely according to the type of soil, but may be as long as five or seven years.

Down in the gorges, where the climate is appreciably milder, and where a primitive sort of irrigation can be practised on the level shelves, both chick-pea and lentils flourish. Some *teff* (a grass-like cereal greatly favoured for making the local bread) can be grown, as well as wheat and barley. Shelf cultivation seems as a rule to be continuous, perhaps because of the fresh sediment spread annually over the fields by rain and irrigation. In the lower parts of the gorges some maize and millet (*Sorghum*) can be found, but almost the whole of the area included on the map is too high for these crops. Other gorge products, unknown on the plateau, are tomatoes, chillies, coffee and *gesho*—a shrub whose leaves are used for fermenting the local beer (*talla*) and honey-wine (*tej*). Bananas, for no obvious reason, are not grown, but are brought to Debra Berhan market from the low country beyond the eastern escarpment.

The agricultural methods of the Ethiopians are far more advanced than those of any surrounding territory and do not belong to Africa. They can be paralleled among the west-Asian peasantry, and a close comparison with the methods of the Yemen mountain people might be especially fruitful. It was from this latter region that the Ethiopians' ancestors emigrated, before the Christian era, and it is extremely probable that they brought with them both implements and a knowledge of techniques. Hence perhaps the use of the plough, universal among highland Ethiopians, and their skill in irrigation and terracing.

Farming in Ethiopia is primarily the man's and not the woman's work, the standard female occupation, apart from household cares, being spinning. (Cotton is widely grown in the lowlands.) The farmers spend most of their lives at the plough, a one-handled variety drawn by a yoke of oxen. In their right hand they carry a whip with a short handle and long, heavy thong which they continually whirl and crack above the heads of the oxen, to whom, at the same time, they address an endless succession of strange howls and shouts, curses and imprecations. New or long-fallowed grassland is broken in with the plough in the dry season. This complicated process (known as *gai*) involves first scratching the ground in several directions to dislodge the turf, next gathering the sods into numerous heaps, then setting fire to these so that grass and weeds are gradually burnt out, and finally spreading out the soil again. But the great time for ploughing comes after the main rains have reduced the countryside to a sea of soft, dark mud. At this season the fields are peppered with ploughmen. Each successive sowing must be prepared

for, and, in the height of the rains when some crops are already up, deep furrows are made at regular intervals, and enlarged from time to time to carry away the surplus rain water.

Irrigation on the shelves of the gorges has already been referred to. But a more elaborate system, the extent of which is shown schematically on the map, has been developed along the river Beressa and its tributary the Maka, which both provide a small flow of water throughout the dry season. The whole enterprise is an interesting example of concerted effort and communal organization—in neither of which are the Amharas usually believed to excel. Its object is to ensure an early crop of barley, to be reaped before the onset of the main rains in June.

The irrigation system has to be partly rebuilt every dry season for the dams, which are constructed of stones and heavy sods, are swept away in the rains. From each dam the water is led off into a well-established furrow, which is carried down in a divergent line from the river and sometimes cut out of the rock on steep scarps. From it minor channels, which can be opened or blocked at will, branch off to irrigate the intervening lands. There are however more complicated systems; thus the dam near Dilila feeds two irrigation channels, one on either bank of the river. The right-bank channel receives its water direct from the dam, that on the left bank by means of an aqueduct carried across the main stream just below the dam and likewise constructed of stones and sods. The flow is not sufficient to feed both at once, so that the water is excluded from one or other branch on different days of the week; while if rain happens to fall the whole system is switched off. The left-bank channel, after running almost parallel to the Beressa for nearly a mile and a half, has to cross obstacles in the form of two tributary streams. The second tributary crossed is a large one, and the irrigation channel, in order to maintain its level, makes a big loop upstream and is then carried over the tributary by means of another wall-like aqueduct 8 or 10 feet high.

During the latter part of the dry season the brilliant green crops of the irrigated area make a striking contrast to the brown and withered aspect of the surrounding countryside. The district (known as Atakilt or "garden") takes its name from this characteristic feature. There are other minor irrigation schemes on the plateau, as on the Dalecha river in the east and the Angolala river in the west of the sheet, but nothing on so large a scale or so elaborately organized as the Beressa system. The Atakilt plains also have historic interest as the scene of the battle, already mentioned, which resulted in the emperor Theodore's annexation of Shoa and the capture of young Menelik.

To conclude this brief account of the agricultural techniques of our area something must be said of terracing and its effect on the landscape. Nothing like the impressive and elaborate terracing practised in some eastern rice-growing countries is attempted in these parts. Many slopes are nevertheless unobtrustively terraced, both in the gorges and on the plateau, and it is not uncommon to see new terraces in process of formation. A wall (*gur*) is built on the lower side of the area selected for improvement, advantage being often taken of any natural flattening of the hillside. The *gur* has a vertical face on

the downward side but is sloped on the up-hill side and therefore triangular in section. The filling-up of the empty space behind the wall, to the new terrace level, may be partly accomplished by hand but tends to be left to nature. During the rains, especially on the steeper slopes, there is a continuous downward movement of soil, which is arrested by the terrace walls and the pockets above them gradually fill up. In the course of centuries an immense amount of simple terracing of this kind has been done, the effect being to accentuate the existing irregularities of the steeper slopes. The landscape has certainly been greatly modified in this way, but it is often impossible to tell at first sight whether a given feature is natural, or partly or wholly due to terracing. It is obvious that such terracing has not only provided additional acreage for agriculture but also served the useful purpose of saving many steep slopes from excessive erosion. In several parts of Ethiopia, including this area, I have seen slopes under cultivation which were so steep that the soil, when loosened and disturbed, would slide away downhill. At first sight one would suppose that such slopes must be completely denuded after a few seasons' rain. The fact that this does not happen is due, I believe, to the vast abundance of stones in these soils, every one of which acts as a minute barrier arresting the flow of water and silt. Nevertheless such slopes, unless terraced, clearly cannot survive indefinitely under cultivation.

Surplus produce is brought in to the big weekly market at Debra Berhan which is both the commercial and the social centre of the whole district; all the main routes radiate from it. Every Saturday morning these routes are thronged with market-goers, who can be seen moving along in an almost continuous stream, the well-to-do mounted on mules, the majority on foot, some driving laden donkeys and pack-mules. The products of this countryside are few, and there is little food surplus, but some wheat and barley come to market, also eggs and chickens and a good deal of butter. Some honey (used in making the local mead or *tej*) comes in, and beeswax is collected for export. Firewood, a scarce commodity on the plateau, is carried in in quantity. *Gesho*, the fermenting agent, comes up from the gorges. There is plenty of earthenware, made on the plateau nearby. From the district of Menz to the north come excellent felt blankets and burnouses. Traders from farther afield bring salt from the desert, partly in the bars which used formerly to pass as currency, and raw cotton and spices from the eastern plains. Textiles and other imported goods now find their way to this market by lorry.

When, in the course of the afternoon, the market crowds begin to stream homewards, one may identify the few simple wares they have bought or bartered. Some have a bag or a bar of salt, some raw cotton for spinning or a piece of cotton cloth, some a fresh supply of coffee-beans, some a bottle of kerosene or a cake of soap. Many have acquired earthenware water-pots or cooking vessels; the large round platters (*matad*) 18 inches across, on which the local bread is baked, stand out conspicuously for they are always carried, for safety, on the head.

It still remains to describe the most potent of the influences which shape the life of the country-bred Amhara—that of the Church. The priests, of

whom many hard things have been said by prejudiced travellers, play so essential a part in almost every aspect of rural life that the community simply cannot be imagined without them. Christenings, funerals and periodic commemorations of the dead are ceremonies of enormous importance which must, of course, be conducted by priests, and their presence is deemed desirable at the higher forms of civil marriage. The *mahabar* or Private Communion, an old social institution deeply rooted among these people, cannot be held unless priests are present, nor can oaths be sworn, or public inquiries made, without them. The traditional customs of the Ethiopian Church, based on those of the Copts but strongly influenced by Judaistic practices, still retain their hold, some would say a strangle-hold, over the rural population. Many long fasts are rigorously observed, besides weekly ones on Wednesdays and Fridays; so are a multiplicity of feast-days when no work may be done, though Saturday is not always observed, as it used to be, as a workless day equivalent to Sunday.

I have already spoken of the large number of churches scattered over this area, especially in the northern half of the sheet, among the gorges. When first wandering about the district I had no idea they were so numerous. But while making the survey I continually came across new ones, and the last two, those nearest the north-east and north-west corners of the sheet, were discovered only while filling in the final detail. They brought the total for this small area up to twenty. They are not elaborate buildings, nor do they conform to the ordinary western conception of a church. They are indeed round huts, quite uninfluenced by the rectangular form (deriving from a very ancient tradition) which exists in the northern part of the country.[1] Some are built in masonry, some in mud-and-stick, and the slightly more pretentious have an outer colonnade of wooden uprights supporting the edge of the roof. Inside one finds two concentric passages surrounding the *makdas*, or Holy of Holies, which only priests may enter. In the distance one can usually recognize a country church by its fine conical thatched roof, which is much bigger than that of any ordinary hut, and is crowned by a sort of double cone carrying a complicated cross, often ornamented with ostrich eggs.

Of the twenty churches, seven were dedicated to the Virgin Mary (Mariam), four to St. George (Ghiorghis), and three to the Archangel Michael, and these are, in general, the most popular dedications. The principal church in Debra Berhan was a Selassie (Trinity), that of Angolala a Kidane Meheret (Covenant of Mercy). There was one St. John, one St. Gabriel, and one each dedicated to the most famous of Ethiopian saints—"Abo" and Tekla Haymanot. Splendid sites have been chosen for most of these churches, the chief consideration having been, it would seem, visibility from afar. The plateau churches are invariably raised on a conspicuous ridge or hill-top. Many are beautifully situated on the shelves in the gorges, or overlooking these. Some again are placed on the extreme edge of a gorge—such are Saria Mikael in the north-east of the sheet and the old St. George, just north of Debra Berhan, now unfortunately moved nearer the town (both sites are marked on the map).

Perhaps the most striking of all these sites is that of Iteghe Mariam, to the

[1] D. R. Buxton, "The Christian Antiquities of Northern Ethiopia," *Archaeologia*, 92 (1947) 1–42.

north-west of Zanjira near the upper margin of the sheet. The church clings to the side of a steep little hill which stands almost isolated among vast gorges and commands the grandest panorama imaginable of this tormented country. The hill is joined to Zanjira by a narrow causeway little lower than the general plateau, flat on top and dropping away in cliffs on either side, so regular that it almost seems artificial. Harris records a saying which evidently refers to this place: "from Iteghe you can see the Echeghe" (*i.e.* the chief of the monks, who then lived in Gondar). To be sure, one does seem to overlook a great part of the world from this point of vantage.

Every church is the centre of a radiating system of small paths (not shown on the map) chiefly used by people coming to service. There are of course regular Sunday services, but these are not very well attended. More important are the special festivals observed on certain dates of the Ethiopian month, which may fall on any day of the week. In this area the monthly festivals universally observed, on which no work could be done, were those of St. Michael, St. Mary, and St. George, on the 12th, 21st, and 23rd respectively, as well as "Bal Wold," a commemoration of the Birth of Christ, on the 29th of each month. Of still greater significance in the life of the people are the annual festivals, falling on the same day of the month as the monthly ones but in certain months only. On these annual festivals nearly the whole population makes its way to the churches dedicated to the particular saint commemorated. Often they will visit the local *tebel* or Holy Water and bathe there early in the morning before service. Going on to the church, all remain outside, for there would be no room for such a crowd within the cramped passages of the church itself. In the middle of the morning the *tabot* or ark is brought out and ceremonial dances held before it. Finally, before the service ends, it will be carried three times round the church in procession, attended by magnificent crosses and gaudy umbrellas. These are occasions of great popular excitement and rejoicing, and the congregations are often enormous. The long service over, they break up into gossiping groups, and go back to social lunches in each other's huts.

Enough has been said to show how large a part is played among these people by the Church and its priesthood. The country has indeed been described as priest-ridden, the people as over-dominated or even enslaved by the Church. If so, this servitude, at least in the country, is still a willing and unquestioned one. It is also true to say that without the Church the social structure of this countryside would fall to pieces, and life would lose not only its coherence but nearly all its variety and colour.

It was mentioned above that, to meet the needs of an increasing plateau population, several new churches had been founded in recent times in the area covered by the map. Two of these were established by "division" of a church which already existed in the gorge. Each original church had two *tabots* one of which was removed for the new foundation, for no church can exist without a *tabot* or altar-slab, this being the only part of the church which is consecrated. Thus the Mariam of the Tallak Amba plateau was derived from the Mariam half-way down the cliff about a mile to the north-east; and similarly a new Ghiorghis of the plateau, just east of Daloti, from the Ghiorghis in the gorge below. Of these "divisions," both of which took place

Church at Abo, Baressa gorge

Monk and deacon receiving offerings

Irrigated land, Atakilt

The ceremony of Timkat (Epiphany), near Debra Berhan

shortly before the Italian invasion of 1935, the first was accomplished peacefully; but not the second. According to the story told me, the *tabot* of the lower Ghiorghis had been borrowed and carried in solemn procession on the plateau in order to ward off a swarm of locusts which were damaging the crops there. This measure was successful, and the plateau people determined to keep the *tabot* which had proved itself so powerful. The people of the gorge would not agree, and tried to recapture their *tabot*. The plateau party however successfully defended it by force of arms, and later built a little church to house it. It was not unusual to attribute specific powers to *tabots*: for instance, that of Dimbaro Mariam (a little east of the north-east corner of the sheet) used to be carried to war by the emperors, attended by a retinue of priests and scribes, to bring success in battle.

The last church to be founded in these parts was the new St. Gabriel, on a prominent hill-top in the district of Dilila near the south-east corner of the sheet. I came upon it when first following the upper course of the Beressa in December 1946. As I approached the foot of the hill I learnt from passers-by that a new church had been built upon it, and that the foundress herself, a certain great lady from Addis Ababa, was at that moment on the hill. Climbing a rocky track to the top, I saw a cluster of new huts and the still unfinished building of the church. Nearby was a large canvas awning stretched rather clumsily between rough stone walls. Under the awning I found the lady herself, short and stout and genial, sitting on a camp chair; around her, squatting on the ground, was a deferential assembly of local dignitaries, personal retainers and priests. After the fluster caused by my unexpected arrival had died down, I had a talk with the worthy lady who, having just presided at a mid-day meal, now plied me with very welcome refreshment. She had been born and bred in this very place. Having spent most of her life elsewhere, and somehow acquired a certain amount of wealth, she had returned in later life to her place of birth and founded this church only the year before my visit. It met a need, she said, for the area lacked a church, and no other St. Gabriel existed anywhere in the neighbourhood. As it chanced, I had come on the day after St. Gabriel's annual festival (which is the 19th of Tahisas, or, in European style, the 28th of December). She expressed great regret that I had not been present at the festival itself, when big crowds had come from Debra Berhan and from all the surrounding country.

This incident seemed to me interesting as demonstrating the tenacity of the local religious tradition in Ethiopia. After all the upheaval and disruption of Italian occupation and the Second World War, the hold of the ancient Church over the Amhara people seemed unweakened. The Church was able to extend its influence in an area not yet well served as readily as ever. It was still an appropriate act for a pious person to found a new church in a lonely place. Perhaps these things are not surprising, for the Church has been the main support and inspiration of Ethiopian unity since the earliest Christian times. It has always been the focal centre of the national sentiment, the fount of renewed resistance to aggression, the main force, in fact, which has maintained Ethiopia's independence and made of it, as Menelik himself once said, an island of Christianity in the great Islamic sea.

I have tried to describe a small section of the old Shoan people in their geographical and historic setting. But this small community, living along the broken edges of the Shoan plateau, typifies the much larger unity of the Amhara nation. Mostly they live in country which resembles either the plateau or the gorges, for they are a mountain people and will not live in the low country; and over most of the Ethiopian highlands their way of life, while varying in detail, is fundamentally the same. Everywhere outside the towns the force of tradition is incomparably stronger than any modern influence, so that life remains, in essentials, what it has been for centuries. I have never come across such a staunch (not to say arrogant) conservatism—a conservatism centred mostly round the old Church which, now as ever, organizes the life of the community. The manifestations of modernity and progress, which now attract some attention in the larger towns, hardly affect the rural picture, and the rural population is content without them. I myself was content without them too, for I valued very highly the experience of sharing the life of a community whose customs, founded on the most ancient traditions, belong essentially to an earlier and to me a congenial age. This was one of the compensations for living in a country where life is necessarily a strain, since the inquisitive foreigner is not really welcome.

THE WHITE NILE FLOOD PLAIN AND THE EFFECT OF PROPOSED CONTROL SCHEMES

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THIS PAPER DESCRIBES some of the results of an investigation which was made into the areas inundated by the White Nile during its yearly flood. The problem arose from the recent proposals [1] for controlling the Nile, which include dams at Lake Albert and Lake Victoria and a canal to by-pass the swamps south of Malakal. One effect of these works would be that most of the present annual fluctuation in the level of the river between Malakal and Khartoum would disappear, with the result that a proportion of these areas would be permanently inundated. Since they form, in the dry season, the major source of grazing for the pastoral tribes which inhabit the region their loss would be a serious matter to the Sudan, and the government was anxious to know just how much would be lost. The inadequacy of the existing maps led me to attempt an estimate of these areas by using such measured cross-sections as existed, though they were spaced at intervals of approximately 20 kilometres along the river. By treating them in an unconventional way it was possible to show that there is an equivalent cross-section, or mean idealized bank profile, which is independent of local variations in the actual channels and flood plain. This mean idealized bank profile makes it possible to estimate the area flooded at any given height of the river quite easily and apparently quite accurately; checks against contoured maps and air photographs confirm the accuracy expected from the internal agreement of the results.

Estimates were required along the whole course of the river from Malakal to Khartoum (Fig. 1). Over the northern third of this reach there are large-scale contoured maps, but for the remainder the maps are uncontoured and on a small scale, and only the cross-sections already mentioned are available. The first part of this paper describes the method evolved for estimating the areas inundated at different levels of the river from these cross-sections. The second part describes some comparisons made between air photographs and cross-sections and also between air photographs and contoured maps where these exist. From these comparisons it is clear that in the northern section both air photographs and contoured maps give very much the same results and are both therefore presumably reliable; but in the southern section, owing to the presence of grass, air photographs can probably only be relied on when they have been taken at the highest or lowest levels of the river. The last part of the paper describes how flooded areas, estimated from cross-sections alone, were compared with the estimates obtained from air photographs taken at high-water level in the southern reach, and from others taken at intermediate levels in the northern, and also with areas estimated from the contoured maps.

[1] Hurst, Black and Simaika, 'The Nile basin,' vol. 7, Cairo, 1946.

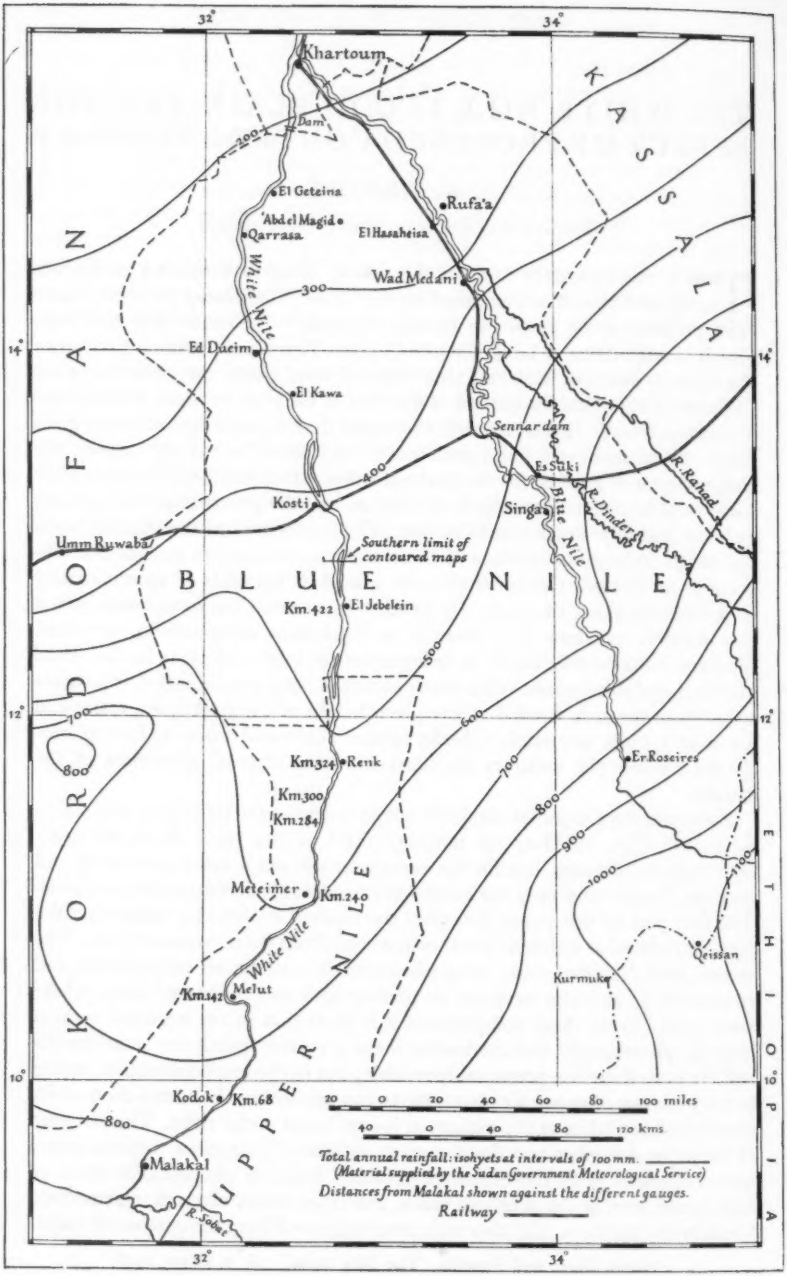


Fig. 1. The White Nile, Malakal to Khartoum

In the course of these comparisons certain characteristics of the flood-plain emerge which are unexpected and not in accordance with the accepted ideas about the Nile; nevertheless they may perhaps be found in other rivers of similar regime elsewhere in the world. Since they have a certain practical value and may even lead to alterations in the present ways of estimating surface areas and volumes for rivers of this type, I feel that they are worth describing in some detail.

Prediction of flood-plain areas from mean idealized bank profiles

The idealization of a single cross-section.—North of Malakal the White Nile can be regarded as a canal with a very flat water slope which varies from about 1·5 centimetre per kilometre when the river is low to approximately 2 centimetres per kilometre when it is high. On general grounds, therefore, a certain uniformity of cross-section might be expected. At first sight the observed sections are anything but uniform, being characterized by a varying number of subsidiary *khors* that run parallel to the main channel (Fig. 2). Nevertheless, if we assume that these subsidiary channels are filled instantaneously as the river rises, the relationship between the height of the water and the width of the newly flooded area varies much less than one would expect. The quantity that shows this comparative uniformity is not so much the total width of the water surface as the width of the additional area of flood-plain submerged by a given rise. In other words, it is not so much the cross-section of the river that is comparatively uniform, but rather the idealized profile of its banks.

The conception of an idealized bank profile can best be understood by considering first the simple case of a channel with a symmetrical cross-section such as a canal. The relationship between a rise of the water from the minimum level and the consequent increase in the width of the water surface can then be expressed directly by the profile of one of the banks, and this relationship is quite independent of the width of the water surface at the minimum level. For, if such a profile is plotted as a curve, and the horizontal scale of the resulting graph halved (in order to include the increase on both sides of the channel), it will show the increase in width of the total flooded area as the water rises. If the curve is made to start at zero when the water level is at the minimum, it will show the total width of the newly flooded land on both banks for any given rise above this datum. It is this land which I have defined as the flood-plain for the purposes of this investigation.

For a canal of symmetrical cross-section the actual and idealized profiles are the same. If the banks are not symmetrical, the curve can still be drawn by adding together the widths of the parts of the flood-plain on each bank. It can also be drawn for the still more complicated case in which there are several low-water channels—by adding together the widths of their separate flood-plains. Given a measured cross-section of any river, however complicated, it is therefore possible to construct such a curve once a datum or minimum water level has been assumed. This curve will represent, on twice the true horizontal scale, the profile of one of the banks of a single symmetrical channel which is equivalent in its flood-plain characteristics to the actual river at that cross-section. The actual river and this idealized channel are

equivalent in the sense that the relationships between the rise in water level and the increase in width of the flood-plain are identical in both (Fig. 3).

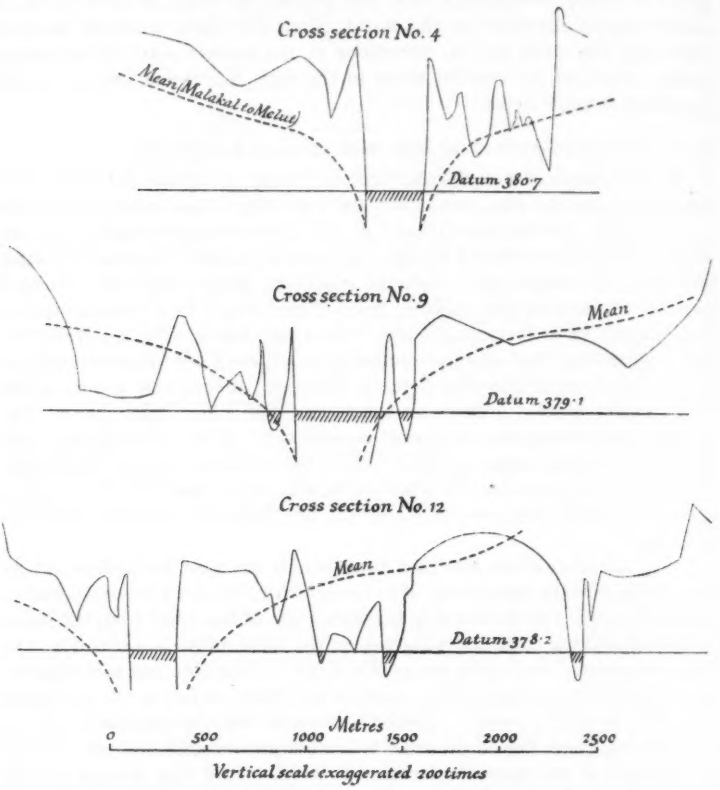


Fig. 2. Three cross-sections compared with idealized means

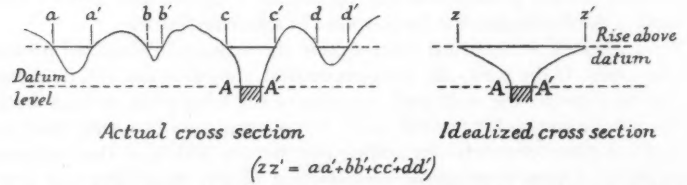


Fig. 3. Diagrammatic relation between actual and idealized cross-sections

The investigation of this relationship is the main subject of the paper and the idealized bank profile is of value because, although the actual cross-sections bear very little resemblance to each other, the curves derived from

them in this way are remarkably similar over long stretches of river. In Fig. 4 the individual curves of the twenty-two cross-sections from Malakal to Jebelein are shown, and in Fig. 5 the curves obtained from twenty cross-sections drawn on the 1/50,000 map at intervals of 7 or 8 minutes of latitude between Jebelein and Jebel Aulia. It can be seen from these that the river between Malakal and Jebel Aulia seems to be divided into three reaches, each with markedly different characteristics. From Malakal to Melut the idealized bank profiles show considerable variation but on the whole are fairly steep; from Melut to just south of Jebelein the variation is small and they are flatter; from this point to Jebel Aulia they are steeper again and show about the same amount of variation as between Malakal and Melut.

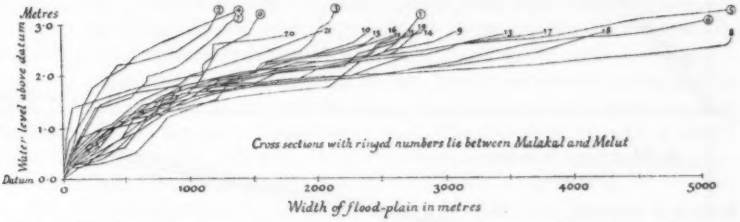


Fig. 4. Idealized bank profiles of individual cross-sections, Malakal to Jebelein

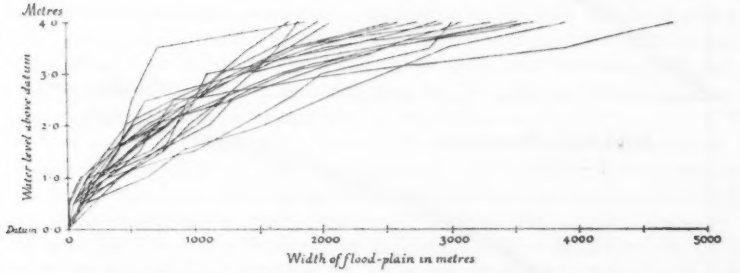


Fig. 5. Idealized bank profiles of individual cross-sections, Jebel Aulia reservoir

Unfortunately there is a gap between the last cross-section at Jebelein and the southern limit of the contoured maps, so that we cannot say exactly where this last change occurs. For practical purposes, therefore, the river has been divided into three reaches; the first extending from Malakal to Melut, the second from Melut to Jebelein, and the third the Jebel Aulia reservoir, which can be taken as roughly defined by the southern limit of the 1/50,000 maps. Why the idealized bank profiles in these reaches should be different cannot at present be satisfactorily explained. Rainfall, the composition of the banks, rate of flow and the seasonal range of water level are probably all concerned. Of these the last seems to be comparatively unimportant, judging from the northern reach in which the seasonal range varies considerably from one end of the reach to the other but the bank profiles remain uniform.

The derivation of a mean.—For our purpose it is enough that this uniformity of idealized bank profile exists in each reach. No doubt it is due to some balance between the river banks and the forces which have gone to shape them. Given this comparatively small variation between individual bank

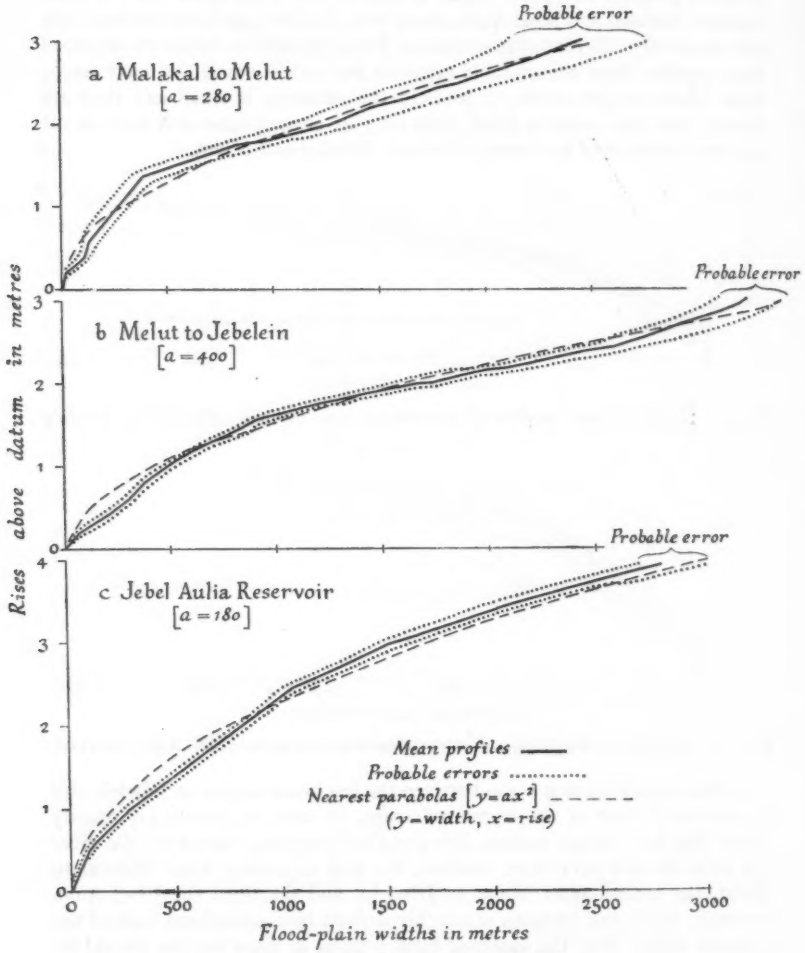


Fig. 6. Mean idealized bank profiles

profiles of any one reach it is obviously possible to derive from them a mean idealized bank profile and to assess its standard deviation and probable error. In this way we can assess the corresponding errors of the calculated mean flood-plain width for each reach at any level of the river. The three mean

idealized profiles are shown, together with their probable errors, in Fig. 6; it is interesting to note that they approximate quite closely to parabolas, and the parabolas of best fit are also shown. It is worth noting too that the probable errors of the last two profiles, in terms of height as opposed to width, amount to little more than 10 centimetres along the whole lengths of the curves. From this it is clear that to make full use of them the water level must be known with the same sort of accuracy.

In order to draw the idealized bank profiles at each cross-section we must first establish a sound series of datum lines relating the profiles to the natural slope of the river. The longitudinal profile of its deepest part, or *thalweg*, is given by a series of levels along the bed of the stream and this is shown in Fig. 8, but it is clear that with such a very gentle mean slope the comparatively large irregularities of the river bed make it impossible to draw a smooth profile of the *thalweg* that would have any meaning. In order to obtain a smooth water profile connecting the datum lines it was therefore decided to use the water surface at normal low river, since it is with the effects of a rise above this that we are actually concerned. The adoption of such a longitudinal profile has the advantage that it reduces to a minimum the variations between individual bank profiles.

The longitudinal profile adopted between Malakal and Jebelein is shown in Fig. 8. It passes through the gauge reading 10·0 metres at Malakal and runs parallel to the normal minimum water levels. The same figure shows longitudinal profiles for nearly every month of a normal year, for the absolute maximum in 1918, and for the absolute minimum in 1922. Three individual cross-sections are shown in Fig. 2 and, at the same scale, the mean idealized bank profiles of the reaches in which they lie. The normal minimum water level was in each case obtained from the datum line of Fig. 8.

In order to make each comparison of the actual with the idealized cross-section more realistic I have included both banks of the corresponding idealized cross-section, and given it a width at low water equal to the mean low water width of the reach concerned, *i.e.* from Malakal to Melut for cross-section No. 4 and from Melut to Jebelein for the other two. In spite of its irregularity, cross-section No. 12 is almost exactly equivalent to the corresponding mean idealized channel or trough, in the relationship between water level and flood-plain width. In the idealized channel or trough, the flood-plain always consists of two equally wide strips, one on each bank; in this typical cross-section it consists of a large number of strips which gradually coalesce as the water rises; nevertheless, when the total flood-plain widths are considered they are practically speaking the same at any given water level.

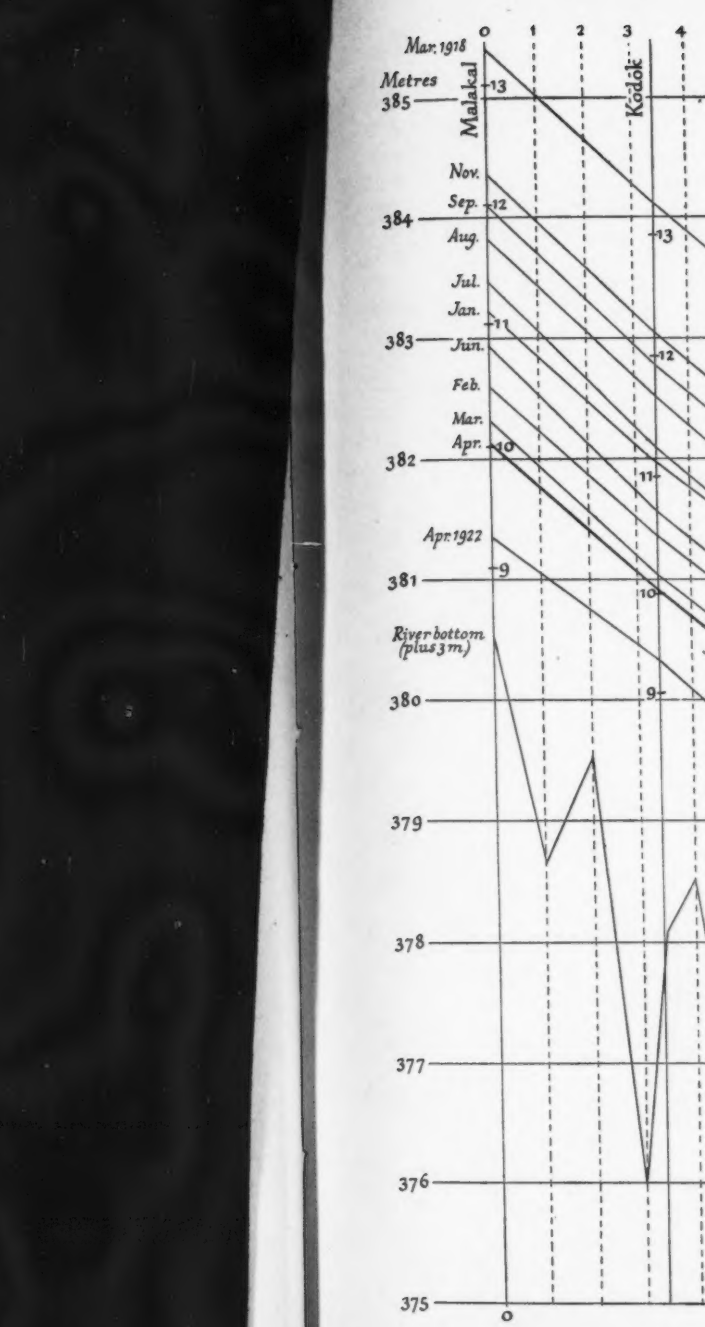
The prediction of flood-plain areas.—We see therefore that these idealized troughs are equivalent for our purposes to the complicated and constantly varying channels and flood-plain of the actual river. It is clear from Fig. 6 that the variations between the means of each of the three reaches are sufficiently large to warrant treating them separately. So far as the Jebel Aulia reservoir is concerned we need go no further because the required areas of flood-plain can be estimated more accurately from the contours of the 1/50,000 map, by interpolation of reduced water levels, than by calculating

them from rises combined with widths derived from the mean idealized bank profile.

It might appear at first sight that in each of the other two reaches, between Malakal and Jebelein, we have now only to take out from Fig. 6 the width of the flood plain corresponding to a given rise in the water level, and then multiply it by the length of the reach, or by the length of any shorter stretch for which the flood-plain area is required. But it was one of the purposes of this investigation to relate these areas to the rise, or to the gauge reading at Malakal; and, as we have seen, the rise is not maintained at a constant figure all the way down the river. Under natural conditions, without the Jebel Aulia dam in action, the rise decreases the whole way downstream until at Jebelein it has only about two-thirds of its original value; when the dam is in action this tendency is reduced and may even be reversed if the reservoir is full and the natural river is low. For example, in the extreme case of a Malakal gauge reading of 10·0 metres combined with a full reservoir, the water at Jebelein stands over 2 metres above the normal minimum, while of course the "rise" at Malakal and also at Melut is then zero.

Thus, in order to relate the flooded areas to the gauge at Malakal, it is necessary to predict the longitudinal profile of the water surface all the way down the river. This was done by predicting the readings at each of the gauges between Malakal and Jebelein corresponding to various combinations of the natural river and the reservoir. Only two states of the reservoir were in fact considered: empty and full. Once the intermediate gauge readings for these two states of the reservoir combined with all possible Malakal gauge readings had been predicted, the river could be divided into sections bounded by the gauges, and mean values for the rises in each section obtained. The method of predicting the longitudinal water profiles was based largely on the use of existing gauge readings and is not described in detail here.

Once the predictions had been made it was possible to obtain from them the resulting mean rises in each section of the river, and from these the corresponding widths of the flood-plain were derived by using the curves shown in Fig. 6. Then, by multiplying each mean flood-plain width by the length of the section, a value for the flood-plain area was obtained corresponding to any given gauge reading at Malakal. By adding these together values were obtained for the whole flood-plain area between Malakal and Jebelein corresponding to any gauge reading at Malakal. Owing to the very few years during which the reservoir had been completely filled (only since 1944), the longitudinal profiles deduced with the reservoir full were not very reliable; but those used for the natural river were based on a great number of readings and could be accepted with confidence. They were therefore assumed to be errorless, and with this assumption the probable errors of the predicted flood-plain areas for the natural river could be computed directly from the probable errors of the mean idealized bank profiles. The resulting errors varied from 15 per cent. when the river was low and the areas themselves fairly small, to about 8 per cent. when the river level was between 1·5 and 3 metres above the normal minimum at Malakal. This is well within the sort of accuracy required. It was proved therefore that, even in this relatively unsurveyed


Mar. 1918
Metres
385
384
383
382
381
380
379
378
377
376
375
Malakal
Kodok
0
1
2
3
4
Nov.
Sep.
Aug.
Jul.
Jan.
Jun.
Feb.
Mar.
Apr.
Apr. 1922
River bottom
(plus 3 m.)
13
12
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10
9

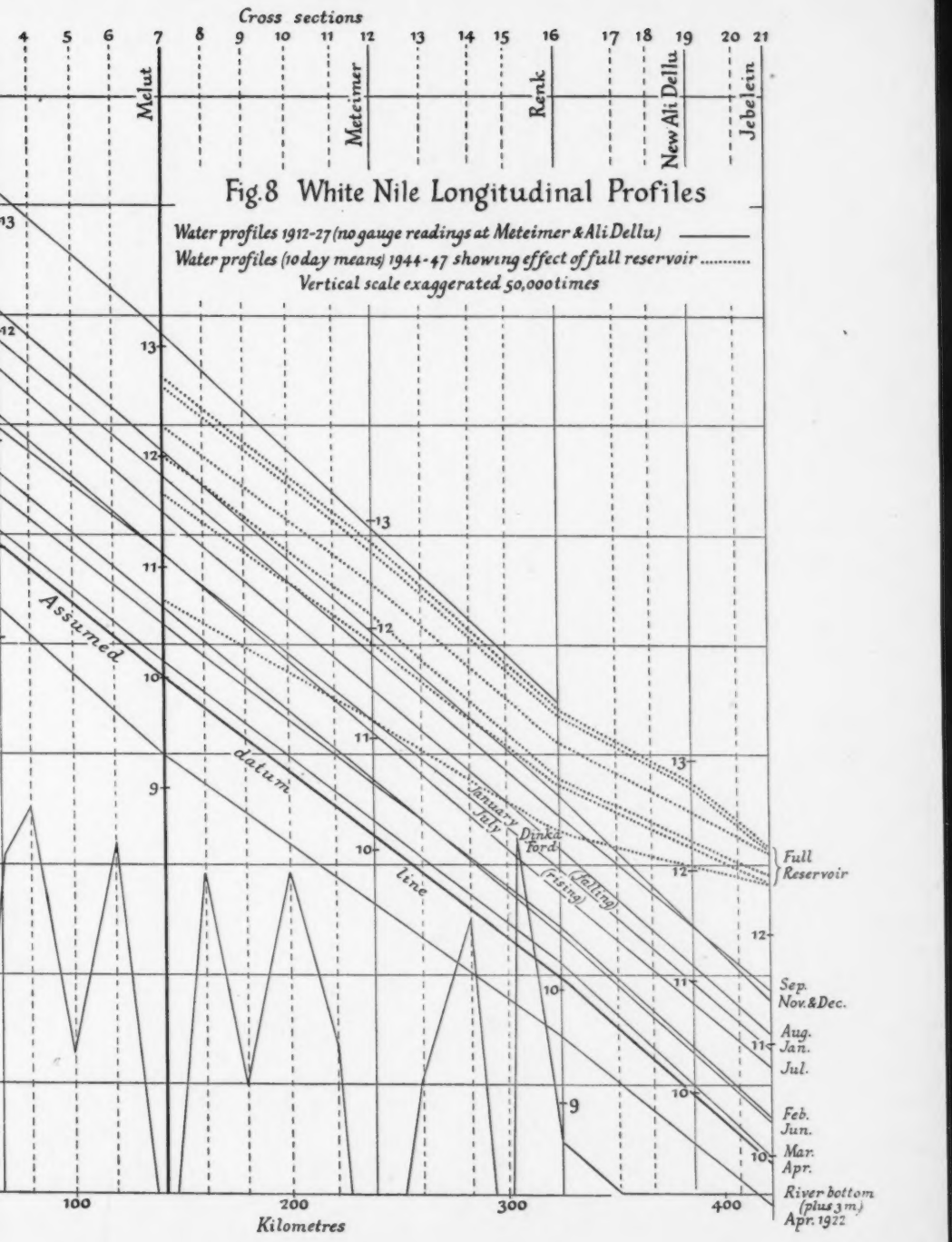


Fig.8 White Nile Longitudinal Profiles

part of the river, the existing surveys were theoretically sufficient to provide an answer, so far as the relationship between the rise in water level and the area of the flood-plain was concerned. The relationship, both for the natural river and for the full reservoir, is shown in Fig. 7.

It will be seen that for the normal range at Malakal the effect of the Jebel Aulia Dam is to flood from 150 to 200 additional square kilometres between Malakal and Jebelein.

It is worth noting that the uncertainty of prediction of the intermediate gauges is considerable, particularly with the full reservoir, because of the few years during which observations have been possible; in fact this uncertainty introduces more errors into the estimates of the total flood-plain areas than the uncertainty of the mean bank profiles, in spite of the relatively few cross-sections from which these have been derived. But for many purposes the

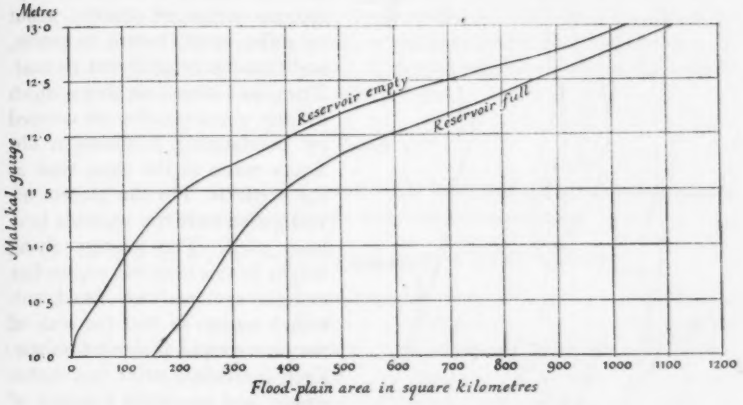


Fig. 7. Flood-plain areas, Malakal to Jebelein

uncertainty of the relationship between the intermediate gauges and those at Malakal and Jebel Aulia is not important. By dividing the river into sections bounded by the gauges we may break up the curved longitudinal water profile into easily handled straight lines, and also produce figures which can be used independently for each section to relate the flooded areas along it to the gauge readings at its ends. For the general purposes of the original problem it was desirable to relate the total flooded areas to Malakal and Jebel Aulia gauges only; but when it comes to practical considerations of the areas owned by individual tribes it will be enough to relate the areas over shorter sections to the nearest gauges. The theoretical shape of the longitudinal profile then ceases to matter, since the part which will be of interest will be short enough to be considered as a straight line. Also, as observations of the intermediate gauges under full reservoir conditions accumulate with the passage of time, the predicted gauge readings at intermediate points will become more accurate.

Comparisons of air photographs and ground surveys

North of Jebelein.—Starting at Jebel Aulia and reaching southwards nearly as far as Jebelein there is a continuous series of 1/50,000 maps contoured at half-metre intervals. Published by the Egyptian Survey Department in 1923, they are based on cross-sections at intervals of half a minute of latitude with no intermediate spot heights. As a result they are often rather generalized, and sometimes unreliable in places where the slopes are flat and on some of the smaller islands where no contours are shown. Moreover, being now twenty-five years old, these maps show few man-made features correctly for most of the roads and canals are of fairly recent origin and many of the villages have been moved in the last quarter of a century.

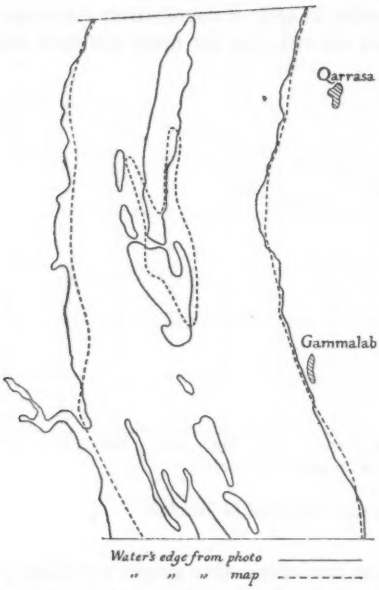


Fig. 9. Flooded areas, comparison between air photographs and maps.

The air survey consists of vertical photographs covering continuous strips of country about 15 miles apart, centre to centre, and running roughly east to west. The gaps between the strips, which average about 9 miles, are covered by overlapping trimetrogon obliques taken at the same time as the verticals. For the present investigation only the verticals have been used. The average flying height in this area was 20,000 feet and the cameras were fitted with 6-inch lenses, so that the scale of the photographs is about 1/40,000. Each individual print is 9 inches square and so covers a square of ground with sides about 9 kilometres long. Within the area covered by the 1/50,000 maps fourteen of these strips cross the river nearly at right angles; but for one reason or other three of them were not used and so only eleven could be compared with the maps. The photographs were all taken in March or April, 1943 or 1944, when the reservoir was emptying and about midway between its highest and lowest levels.

For lack of detail on the maps, the photographs had usually to be located by comparing permanent natural features such as steep river banks, where little change would be likely to occur either with the passage of time or with a change of water level. An American "sketch-master" was used to obtain the best mean fit between map and photograph, and the water's edge as seen on the latter was then drawn on a piece of tracing paper superimposed on the map. The result was a plot of the water-covered area on a scale of 1/50,000. The sketch-master is an arrangement of mirrors which superimposes a rectified

image of the air photograph on an image of the map and allows the two images to be brought to the same scale. The Egyptian Irrigation Department kindly supplied the reduced levels of the water surface at the places covered by the photographs on the dates when they were taken. These levels were interpolated on the 1/50,000 maps and copied on the tracings on which the water's edge had been plotted from the photographs. Thus each tracing afforded a direct comparison between deduced and plotted water's edge. One of the comparisons is shown as an example in Fig. 9. The area included by each of the lines was measured by planimeter, and the results are shown in Table 1. In the cases marked in the table with an asterisk there were islands not contoured on the maps which were therefore omitted from the comparison of areas. It will be clear from this table that, over any reasonably long stretch of river in the Jebel Aulia reservoir, air photographs and existing maps will give the same results within a small percentage. Two cases show comparatively large discrepancies; these cannot be accounted for unless by the small size of the areas concerned or possibly by the fact that they are far enough south to come into the area of denser vegetation where the water's edge cannot be clearly seen on the photographs.

TABLE 1

Comparisons between areas under water in the Jebel Aulia Reservoir as computed from air photographs and from contoured maps

(*Reduced levels in metres and areas in square kilometres*)

Latitude	*Water Level*	*Area Computed from Photo-graphs*	*Map Contours*	*Difference*	*Diff. as Percentage of Area*
14° 57′	373·85	21·08	20·44	+0·64	3·0
14° 45′	375·17	26·30	26·44	−0·14	0·5
14° 38′	375·18	25·28	25·94	−0·66	2·6
14° 28′	375·07	27·24	27·11	+0·13	0·5
14° 00′	373·76	10·02	10·28	−0·26	2·6
13° 45′	374·50	14·25	14·10	+0·15*	1·1
13° 31′	374·62	13·91	13·48	+0·43*	3·1
13° 20′	379·43	13·41	12·52	+0·89	6·6
13° 07′	374·67	9·59	11·42	−1·83	19·1
13° 02′	375·33	11·52	11·10	+0·42*	3·6
12° 52′	375·14	6·89	7·90	−1·01	14·7
	Totals	179·49	180·73	−1·24	0·7

South of Jebelein.—For the stretch of river between Malakal and Jebelein there are no maps with detailed contours; but in 1928, 1941 and 1942, the Egyptian Irrigation Department made a series of cross-sections at approximately equal intervals of 20 kilometres. There are twenty-two sections in all, numbered from 0 at Malakal to 21 at Jebelein. These cross-sections were plotted on horizontal and vertical scales of 1/20,000 and 1/100 respec-

tively, giving a vertical exaggeration of 200. On this reach are there relatively more air photographs than north of Jebelein because the river was used as a boundary between two areas that were surveyed from the air at different times. In addition to a series of strips running westwards from the river and taken in the spring of 1944, when the level was at its seasonal lowest, there is another series running eastwards and taken in the autumn of the same year when the water was fairly high. The latter series also includes one strip running the whole length of the river from Malakal to Renk.

Several reaches are covered by both series of photographs, and their appearances at low and high water can thus be directly compared. As far as the apparent water's edge is concerned the results of the comparison are quite negative; on both sets of photographs the edges of the low-water or perennial channels can be seen clearly but, even when the sun is shining on it, the part of the flood-plain that is covered with water cannot be identified directly. On those taken at high water, the main channel is however bordered by a dark band which seems to coincide with the probable extent of the maximum area flooded during the year. These photographs were taken on November 24 after the river had been in flood for some time, yet no water can be seen; the dark colour is therefore most probably due to new vegetation rather than to the actual presence of water. The conclusion is that the edge of the water at intermediate levels during the flood season cannot be plotted from vertical air photographs taken at a high altitude. It is possible that obliques taken from a few thousand feet might be easier to interpret, but a considerable number of experiments would be necessary before any extensive programme of flights could safely be put in hand.

Six vertical photographs cover the sites of Egyptian Irrigation Department cross-sections at a time when the river had been stationary at its seasonal maximum for about a fortnight. Each of these would therefore seem to offer an opportunity of making a direct comparison between the width of the dark band already described and that of the area flooded when the photographs were taken. Unfortunately the only data available for locating the cross-sections were copies of the 1/250,000 map on which they had been marked by hand; the accuracy of this map was insufficient for them to be surveyed on to it. Comparison of the map with the photographs reveals that the relative locations of these and the cross-sections cannot in most cases be established for certain within a kilometre or two. It was found in the course of tests which are described below that even in such a short distance as this the width of the flood-plain can change by several hundred metres, and indeed this is obvious from direct observation on the ground. Clearly, no worthwhile comparisons can be made until the relative locations of the air photos and the cross-sections can be established with considerably greater accuracy. The difficulty of accurate location can be overcome, or rather eliminated, by comparing areas; but in order to do this, it is necessary to estimate the mean width of the flood-plain along a reasonably long stretch of river, rather than the width at any one point which happens to lie within that stretch. The best way of estimating this mean width over a long stretch has already been considered. The best way of estimating the mean width over a shorter stretch is described below.

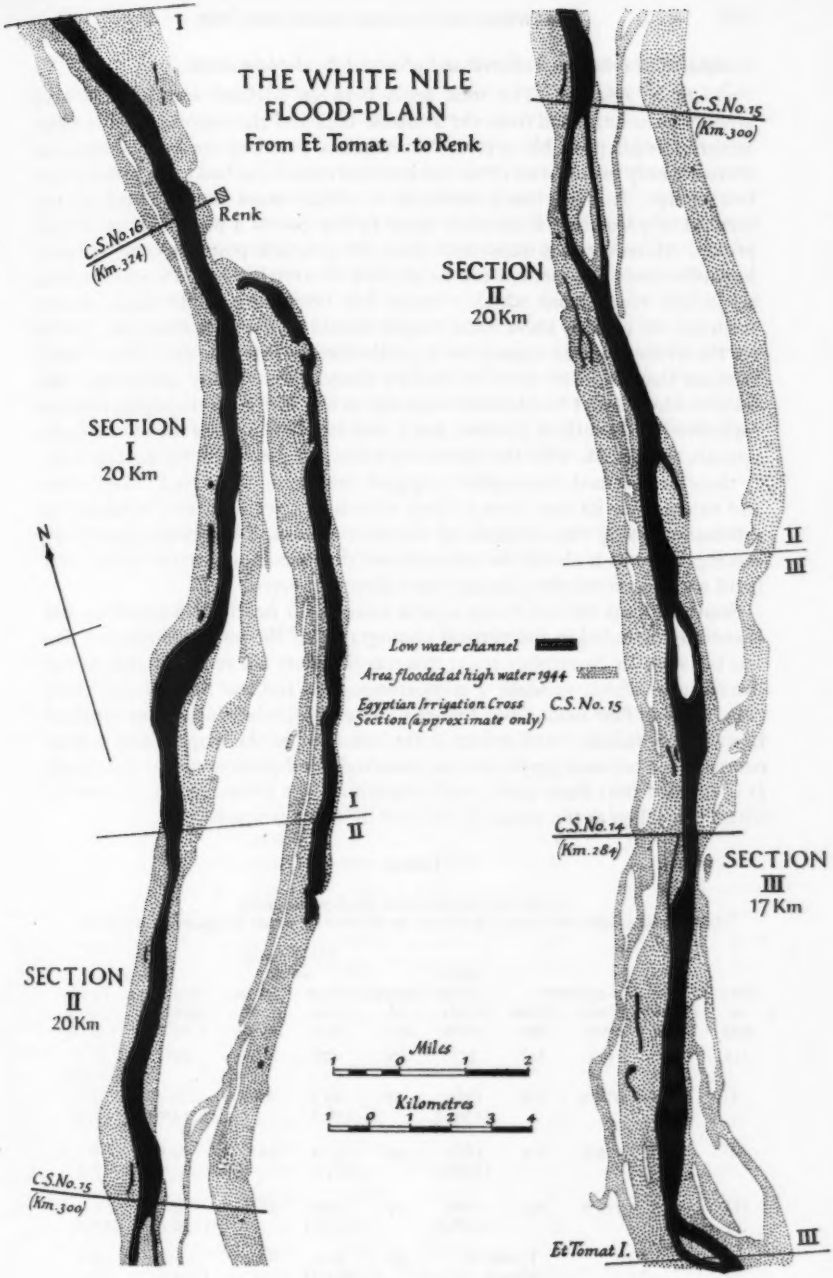


Fig. 10. Part of the White Nile flood-plain

Comparisons between predicted and observed flood-plain areas

South of Jebelein.—The total areas between Malakal and Jebelein have already been estimated from the available data and they appear to have satisfactorily small probable errors. Nevertheless the data are very scanty, for there are only twenty-two cross-sections and even these had to be divided into two groups. It is obviously desirable to obtain some sort of check on the method of predicting flood-plain areas by the use of a mean idealized bank profile. Moreover it is important, from the practical point of view, to know how effectively the method can be applied to stretches that are shorter than the whole reach from which a mean has been derived. In such shorter stretches we want to know what weight should be given to the mean profile for the whole reach as opposed to a profile derived from the one or two cross-sections that lie in or near the shorter stretch. As already mentioned, the water's edge cannot be identified directly in any of the photographs taken at high river level south of Jebelein, but a dark band on some of the photographs appears to coincide with the maximum extent of the water during that year. It therefore seemed reasonable to regard this as an "observed" flood-plain and to compare its area over a short stretch of river with that obtained by estimation, using the methods of the first section. The results justify the assumption, but it should be remembered that the identification of the dark band with the flood-plain has not been directly proved.

South of Renk the river runs almost straight for nearly 60 kilometres, and is entirely included in the vertical photographs of the longitudinal strip that was taken on 14 November 1944; this was therefore the most suitable part of the river in which to make a comparison. A 1/100,000 map of this reach (Fig. 10) was first made from the air photographs, whose scale was obtained from astronomically fixed points at the two ends of the map. Table 2 gives comparisons between predicted and observed flood-plain areas for this reach. It is divided into three parts, each containing one cross-section, the rise at which was taken as the mean for the part in which it was located.

TABLE 2

Predicted and observed flood-plain areas
(*Levels and widths in metres; distances in kilometres; areas in square kilometres*)

Sect. on map	*Cross-sections*			*Mean width flood-plain*	*Length of sect.*	*Flood-plain areas*		*Differences*	
	Datum level	*Water level*	*Mean rise*			*from cross-sects.*	*from air photos*	*Col. 7 minus Col. 8*	*Ratio: Col. 9 / Col. 8*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
									per cent.
I	377·0	378·9	1·9	1460 (1340)	20	29·2 (26·8)	28·8	+0·4 (−2·0)	1·4 (6·9)
II	377·3	379·3	2·0	1670 (1460)	20	33·4 (29·2)	30·9	+2·5 (−1·7)	8·1 (5·5)
III	377·6	379·6	2·0	1680 (2180)	17	28·6 (37·1)	28·7	−0·1 (+8·4)	0·3 (27·2)
			Totals or Means		57	91·2 (93·1)	88·4	+2·8 (+4·7)	3·2 (5·3)

The cross-sections concerned are those situated 324, 300 and 284 kilometres from Malakal; the water levels in column 3 were supplied by the Egyptian Irrigation Department. Where there are two sets of figures in one column the first is based on the mean idealized bank profile for the whole reach from Melut to Jebelein, and the second (in brackets) on the measured cross-section itself. It will be seen that the agreement with the air photographs is definitely closer in the first case than in the second. This result suggests that even for quite short reaches it is more accurate to use a mean idealized profile averaged over a long distance than to rely on the nearest cross-section.

North of Jebelein.—The Jebel Aulia reservoir was also used for testing the relative accuracy of these two methods, by comparing results derived from the contoured maps with estimates from individual and mean idealized bank profiles obtained as already described. In the first series of tests, ten cross-sections were measured from the map at intervals of one minute of latitude on either side of the main cross-sections already mentioned; flood-plain widths were compared at each half-metre rise above low levels.

TABLE 3

Comparisons between flood-plain widths predicted from cross-sections and measured from contoured maps

(*Levels and widths in metres*)

	Width derived from			*Differences*		*Ratios*	
Rise above datum	*Local mean*	*Central section*	*Long-distance mean profile*	*Col. 2 minus Col. 3*	*Col. 2 minus Col. 4*	*Ratio: Col. 5 / Col. 2*	*Ratio: Col. 6 / Col. 2*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Latitude 13° 22′			*per cent.*	*per cent.*
0·5	150	100	85	+50*	+65	33	57
1·0	370	400	260	+30*	+110	8	30
1·5	585	750	530	−165	+55	28	9
2·0	790	950	790	−160	0	20	0
2·5	1080	1200	1060	−120	+20	11	2
3·0	1490	1450	1495	+40	−5	3	0
3·5	2095	1650	2075	+445	+20	21	1
4·0	2770	1800	2800	+970	−30	35	1
			Latitude 14° 37′				
0·5	100	100	85	0*	+15	0	15
1·0	245	150	260	+95	−15	39	6
1·5	470	350	530	+120	−60	26	13
2·0	715	700	790	+15*	−75	2	10
2·5	1040	1000	1060	+40	−20	4	2
3·0	1490	1400	1495	+90	−5	6	0
3·5	2035	1750	2075	+285	−40	14	2
4·0	2520	2050	2800	+470	−280	19	10

The tests were made for points near Fashashoya (Lat. 13° 22′) and near Qarrasa (Lat. 14° 37′) and the results are exhibited in Table 3. The local means are derived from the ten cross-sections at one minute intervals, and the mean idealized profile is derived from the whole reach from just north of Jebelein to Jebel Aulia. Except for the four cases marked with an asterisk, the value derived from the long distance mean idealized profile is much nearer to the contoured map than is the value derived from the central cross-section itself. The average errors are: 17 per cent. using the central section, and 10 per cent. using the long distance mean.

The second series of tests consisted in predicting, by the method of idealized profiles, the total water-covered areas (including the low-level river channel as well as the flood-plain proper) for the reaches in the Jebel Aulia reservoir already examined in Table 1. They are about 10 kilometres long, and rather short for predictions using a long-distance mean, and a mean value for the low-level width had also to be used. Nevertheless the results given in Table 4 show that the mean idealized profile for the whole reservoir and the mean low-level width are more reliable than the nearest cross-section as a basis for predicting the flooded areas. The two cases out of eleven where the latter proved more accurate are marked with an asterisk in the table. It will be seen that on the average the errors in prediction resulting from the use of the nearest cross-section are over twice as large as those resulting from the use of the long-distance mean.

Summary of results

Both north of Jebelein, in reaches from 6 to 12 kilometres long, and south of Renk, in reaches of about 20 kilometres, the local variation was found to be as great as that between cross-sections as much as 200 kilometres apart. Thus it is shown fairly conclusively that, on this part of the White Nile at least, in order to predict the area flooded over a stretch of river not less than about 8 kilometres long, it is more accurate to use a width derived from the mean idealized long-distance bank profile than one derived from a single cross-section. This is true even when the cross-section lies right in the middle of the area. It is, however, unlikely that such good results would be obtained between Malakal and Melut,[1] where the variation between the bank profiles of individual cross-sections is much greater. Nevertheless even here reasonably accurate prediction should be possible provided that the reach considered is fairly long. Thus it seems that, for the whole distance from Malakal to Jebel Aulia, the total, certainly, and probably also the local, flood-plain areas

[1] Since this was written, an extension of the 1/100,000 maps, compiled from air photographs such as were used south of Renk, has made it possible to carry out between Malakal and Melut a test similar to that shown in Table 2. The theoretical and "observed" flood-plain areas differed by 11 per cent. and the same local variation of width was observed. In seven stretches, each 20 kilometres long, the observed flood-plain width was always closer to that derived from the mean idealized bank profile than to that derived from the mean of two cross-sections, one at each end of each 20-kilometre stretch. The average differences between "observed" and predicted areas were respectively 12 per cent. and 26 per cent. Again therefore the mean profile for the whole reach gave, on the average, a result twice as close to the observed area as did the nearest cross-section.

TABLE 4

Comparisons between total water-covered areas predicted from the mean idealized profile and measured from air photographs and contoured maps (Jebel Aulia Reservoir)

(Lengths in kilometres, levels and rises in metres, areas in square kilometres)

	Data used for prediction				*Water-covered areas derived from*				*Errors (Map contours assumed correct)*		
Latitude	*Datum level*	*Water level*	*Rise*	*Length of reach*	*Map contours*	*Air photos*	*Nearest cross-section*	*Mean profile*	*Air photos*	*Nearest cross-section*	*Mean profile*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
14° 57′	371·1	373·8	2·7	9·9	20·4	21·1	15·0	20·3	+0·7 (3·4%)	−5·4 (26·5%)	−0·1 (0·5%)
14° 45′	371·3	375·2	3·9	9·0	26·4	26·3	27·0	29·8	−0·1 (0·4%)	+0·6 (2·3%)	+3·4 (12·9%)*
14° 30′	371·5	375·2	3·7	8·1	25·9	25·3	22·5	24·3	−0·6 (2·3%)	−3·4 (13·1%)	−1·6 (6·2%)
14° 28′	371·7	375·1	3·4	9·0	27·1	27·2	22·5	23·9	+0·1 (0·4%)	−4·6 (16·9%)	−3·2 (11·8%)
14° 00′	372·2	373·8	1·6	8·6	10·3	10·0	14·2	11·3	−0·3 (2·9%)	+3·9 (37·9%)	+1·0 (9·7%)
13° 45′	372·5	374·5	2·0	8·4	14·1	14·2	8·8	13·0	+0·1 (0·7%)	−5·3 (37·6%)	−1·1 (7·8%)
13° 31′	373·7	374·6	1·9	8·4	13·5	13·9	16·8	12·6	+0·4 (3·0%)	+3·3 (24·4%)	−0·9 (6·7%)
13° 20′	373·0	375·4	2·4	8·1	12·5	13·4	14·5	14·2	+0·9 (7·2%)	+2·0 (16·0%)	+1·7 (13·6%)
13° 07′	373·3	374·7	1·4	12·0	11·4	9·6	14·4	14·7	−1·8 (15·8%)	+3·0 (21·3%)	+3·3 (29·0%)*
13° 02′	373·5	375·3	1·8	8·7	11·1	11·5	13·0	12·4	+0·4 (3·6%)	+1·9 (17·1%)	+1·3 (11·7%)
12° 52′	373·6	375·1	1·5	6·4	7·9	6·9	9·6	8·2	−1·0 (12·7%)	+1·7 (21·5%)	+0·3 (3·8%)
				Totals	180·6	179·4	178·3	184·7	−1·2	−2·3	+4·1
								Means	4·8%	21·3%	10·3%

that will be lost by any given rise in the minimum river level can be predicted with the accuracy required. Yearly variations in the river level, together with uncertainty about the effect of filling the Jebel Aulia reservoir, must in fact be very much greater sources of error than the actual relationship between the alteration in water level and the resulting alteration in the areas that are flooded.

Conclusion

This investigation provided an adequate answer to the immediate problem, but it has raised a number of other questions which are of considerable interest. So far as I have been able to discover this treatment of a river channel is original, but it may not be so, and I should be very grateful for any references to work along the same lines by other writers. It would be of great interest to try the method on another river of apparently similar characteristics; that is, one with a fairly gentle slope, an appreciable range in level, no important tributaries, and a series of braided channels giving a complicated cross-section. The necessary data for applying the method are either closely contoured maps, or a series of cross-sections connected by levelling; and a series of gauges connected by levelling from which an idea of the longitudinal water profiles can be obtained. There may not be many rivers fulfilling all these conditions but there must surely be some, if not in England or America, then in the alluvial plains of India or China. If similar characteristics could be proved for other rivers there would be a basis for comparison, and one could try to gain some idea of the relative importance of the various factors—rainfall, seasonal change of level and flow, bank material, and so forth—which must all play their part in determining the shape of the mean bank profile. Not only is this entity of some significance on the White Nile, but it seems to approximate always to a parabola; there is also some evidence that the local variation of the flood-plain width sometimes has a definite period in terms of distance along the channel.

These are fascinating problems worthy of further investigation and on this I have started by using the methods described in this paper to make a hydrological analysis of the White Nile and Sobat floods, based on discharges and gauge readings at various points. The Sobat enters the White Nile just south of Malakal and is mainly responsible for its fluctuations. Unfortunately no cross-sections of its valley have been surveyed, but this analysis indicates that its flood-plain is probably similar to that of the White Nile and I am pursuing this promising lead.

Acknowledgements

By kind permission of the Sudan Government I have been able to include without alteration large sections of my report on the investigation. I am greatly indebted to the Egyptian Irrigation Department in the Sudan for their assistance in making available much unpublished material; to Mr. H. A. Morrice of the Sudan Irrigation Department for a critical check of the original draft of that report and for comments on this paper; and to Mr. R. C. Wakefield, Director of the Sudan Survey Department, for helpful and constructive criticism throughout the work.

1. Hog's-back cliffs, Combe Mastin

2. Flat-topped cliffs, Hartland Quay

CLIFF PROFILES OF DEVON AND CORNWALL

MURIEL A. ARBER

THE COAST SCENERY of North Devon and of North and West Cornwall consists mainly of rugged cliffs, ranging in profile from the hog's-back slopes around Lynmouth to the sheer precipices of Morwenstow. The loftiest hog's-back cliffs (Plate 1) are those in north-east Devon between Combe Martin and Foreland Point, extending still farther east across the Somerset border. The Great Hangman near Combe Martin has a crest 1044 feet above sea-level about 300 yards inland, whence a straight vegetated slope of gradient approaching 1 in 1 descends to the very base, which alone is now subject to wave attack. The cliffs between Hartland Point and Widemouth afford a complete contrast. An inland plateau sloping gently towards the sea is cut clean by an almost vertical cliff face, 400 feet high near Morwenstow and nearly 300 feet high at Hartland Quay (Plate 2). Where the profile, as at the Lizard and the Land's End, does not conform to either of these two extremes, a vegetated slope curves in a bevel from the level surface above to the vertical cliff face below. The curve may be concave (Plate 3) or convex (Plate 4).

The greater part of the area considered in this paper (see map) consists of Devonian and Carboniferous rocks. Along the coast the commonest of these are hard grits, shales, sandstones and slates; there are also small outcrops of Devonian igneous rocks. At the end of the Carboniferous period the region was evidently subjected to severe pressure along Armorican lines, resulting in a series of folds with east and west strike. The north of the area is occupied by a great synclinorium, so that in North Devon the regional dip is to the south while along the coast, roughly from Boscastle to Morwenstow, it is to the north. During the same orogeny the great granite domes of Devon and Cornwall were intruded, which outcrop on the mainland coast at the Land's End.

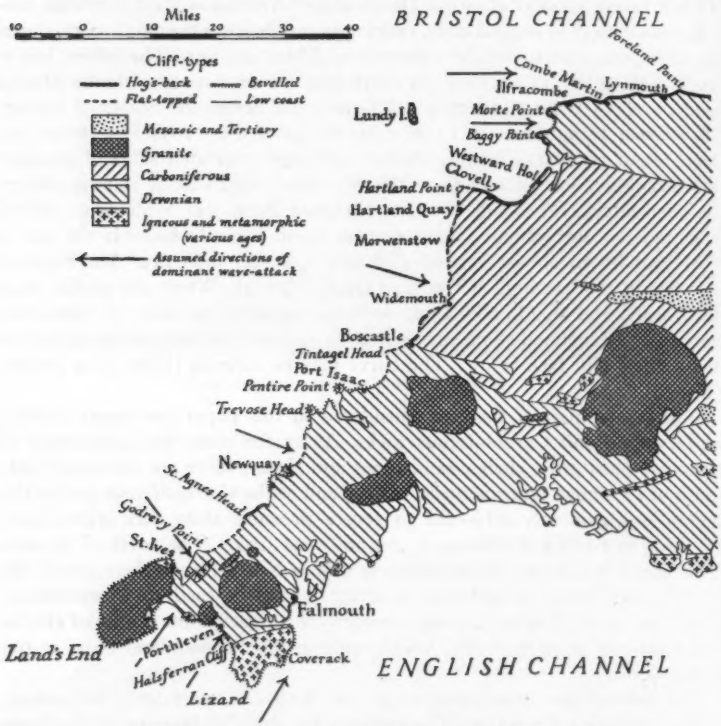
The cliffs of the Lizard complex are for the greater part cut in serpentine, gabbro, schists and granite. Whether they are Pre-Cambrian or, as has been suggested, Devonian, their extreme hardness has left them outstanding as the most southerly point of the English coast.

On any coast, the shoreline tends to develop at right angles to the direction of dominant wave attack.[1] Bays in the process of adjustment thus become asymmetrical with a longer smoother side facing the dominant waves, as in the larger bays of Devon and Cornwall.[2] We can therefore assume that a line

[1] W. V. Lewis, "The evolution of shoreline curves," *Proc. Geol. Assoc.*, 49 (1938) 107–27. Lewis's observations have been confirmed experimentally by R. A. Bagnold, "Beach formation by waves; some model-experiments in a wave tank," *J. Inst. Civil Engineers*, 15 (1940–41) 27–52.

[2] M. A. Arber, "Outline of south-west England in relation to wave-attack," *Nature*, 146 (1940) 27–8.

drawn at right angles to the chord of the longer smoother side of a bay represents the direction of dominant wave attack. The arrows thus inserted in the map indicate that in South Cornwall the dominant approach is from the south-west, while on the north coast it is from the north-west or west. In each major bay, the western arc has been protected by the nearest headland to the west from the smoothing and blunting effect of the wave attack.[1] The Lizard, the Land's End granite, the St. Ives greenstone, St. Agnes Head,



Cliff-types between Foreland Point and Falmouth

Towan Head at Newquay, Pentire Point, Hartland Point and Morte Point thus exert a direct influence on the profile of the cliffs, since those which are exposed to full wave attack are cut back much farther and are usually much more sheer than those which lie under the lee of the promontories.

Hog's-back cliffs

The term "hog's-back" was suggested for these cliffs by my father, the late E. A. Newell Arber,[2] who discussed their nature and origin but left the

[1] M. A. Arber, "Outline of south-west England in relation to wave attack," *Nature*, 146 (1940) 27–8.

[2] E. A. N. Arber, 'The coast scenery of north Devon,' London, 1911.

problem of their evolution frankly unsolved. He pointed out that although they are more typical of Devonian than of Carboniferous rocks, they appear to develop independently of lithology; and that profiles similar to those on the coast are seen in the inland valleys, for instance in Exmoor Forest. Since my father's death in 1918, his discussion has been quoted by Steers [1] and the question has been reconsidered by Balchin. Balchin [2] observed that in North Cornwall the hog's-back cliffs developed where the coast ran parallel to the strike, the beds either dipping seawards or presenting a scarp surface to the sea. He rejected the possibility that these cliffs were a remnant of a Pliocene coastline due to marine planation at 180 feet above present sea-level, but later suggested [3] that they were developed during the severe arctic conditions and solifluction which accompanied the formation of "head" at a period of lower sea-level than the present.

From my own observations,[4] I have come to the conclusion that the existence of hog's-back cliffs is directly dependent on geological structure. Where the true hog's-back is developed on the grandest scale, near Combe Martin, the regional dip is southerly and thus inland, so that the seaward slope from the crest is simply an escarpment cutting across the edges of the beds (Plate 1). Inland from the crest is a gentler dip-slope into a valley running more or less parallel with the coast, the opposite (southerly) side of the valley being another escarpment. The scarp-dip form is often repeated in the inland topography where it may be noticed that the southerly, escarpment slope faces a gentler dip-slope on the north.

Since only the base of a hog's-back cliff is at present being cut by the sea, its distinctive profile must be due to subaerial weathering. Its steepness thus depends on the pre-existing inland topography; the Lower Devonian beds east of Combe Martin, for example, weather into loftier hills and cliffs than the Middle Devonian beds towards Ilfracombe. The detailed lithology however appears to have little effect, the profile of the cliffs being controlled much more by the degree of the dip. Where the beds are roughly horizontal, as occurs locally in the Torrs at Ilfracombe, the cliff-face is almost vertical. The slates of Morte Point are almost horizontal so that both flanks are cut across the sharp edges of the beds. The northern flank of Baggy Point is a true escarpment, but here the superficially similar south-western flank is a perfect dip-slope (Plate 5). Beeny and Penally Cliffs near Boscastle are also dip-slopes; they are neither so deep nor so straight as the true hog's-back.

Another variety of hog's-back is the irregular slope which cuts somewhat obliquely across the scarp as in Rillage Point near Ilfracombe. Distinction cannot always be drawn between hog's-back, bevelled and flat-topped forms; intermediate grades have been grouped on the map with the type to which they most nearly approximate.

[1] J. A. Steers, 'The coastline of England and Wales,' Cambridge, 1946.

[2] W. G. V. Balchin, "The erosion surfaces of north Cornwall," *Geogr. J.* 90 (1937) 52–63.

[3] *Idem.*, "The geomorphology of the north Cornish coast," *Trans. R. Geol. Soc. Cornwall*, vol. 17, pt. 6 (1946) 317–44.

[4] The present paper was almost completed before Mr. Steers drew my attention to Mr. Balchin's work. My observations on the relation of the hog's-back and flat-topped cliffs to the dip and strike are therefore entirely independent of his.

Since marine erosion is relatively unimportant in shaping them, hog's-back cliffs are found on those stretches of coast which are protected by a headland from dominant wave attack. The main series is east of Morte Point where the coast runs east and west, parallel to the strike. Farther west, hog's-back cliffs occur under the shelter of Hartland Point but are very much broken where this protection ceases at Greenacliff near Westward Ho! East of Boscastle, the cliffs are much exposed to the force of the sea and the wave-cut base occupies a greater proportion of the cliff height at the expense of the subaerial slope; but even here the cliffs are protected where they form the sides of the inlets, as at Pentargon between Boscastle and Beeny. Near St. Agnes Head there is so little shelter that the hog's-back slope has been worn away altogether on the more exposed faces.

Flat-topped cliffs

E. A. N. Arber considered that flat-topped cliffs are simply a result of marine erosion of a plateau. Unfortunately his illustrative section [1] represents the beds dipping inland whereas they should appear horizontal, since the section is drawn along the strike. Balchin [2] observed that vertical cliffs develop where the coastline cuts across the strike.

As the dominant wave attack comes from the west, those stretches of coast which run north and south are fully exposed to it. At the same time, in North Devon, because the strike of the great Devonian and Carboniferous syncline is east and west, there are no structural planes running parallel to such coasts and the cliffs cannot be readily attacked by subaerial erosion to produce a profile sloping away from the sea; hence they drop sheer from a more or less level summit (Plate 2). The cliffs between St. Agnes Head and Godrevy Point are landslipped. This may be due to the fact that the coast here is again exposed to full wave attack but runs parallel to the regional strike. Marine erosion has been able to act on dip-planes exposed in the cliffs.

The development of flat-topped cliffs from hog's-backs may be seen in Gallantry Bower west of Clovelly. East of Gallantry Bower the shelter of the Hartland promontory has allowed a true hog's-back to develop, but to the west the protection is reduced and the subaerial slope has been cut back until a flat-topped cliff is the result. Other flat-topped cliffs as at Bedruthan Steps near Newquay, have developed from the cutting back of a former bevelled profile which still survives in the stacks and headlands.

Bevelled cliffs

Reid and Flett [3] described the slope which curves from the coastal plateau down to the vertical cliff in West Cornwall; they concluded that it was probably formed during later Pliocene times but that its exact date and mode of origin were uncertain. Reid, Barrow and Dewey [4] discussed the bevel as

[1] E. A. N. Arber, *op. cit.*, fig. 3, p. 14.

[2] Balchin, *op. cit.*, 1937.

[3] C. Reid and J. S. Flett, "The geology of the Land's End district," *Mem. Geol. Surv.*, 1907.

[4] C. Reid, G. Barrow and H. Dewey, "The geology of the country around Padstow and Camelford," *Mem. Geol. Surv.*, 1910.

3. Bevelled cliffs, Nanjizal, near Land's End

4. Bevelled cliffs, Port Isaac

5. Hog's-back dip-slope cliff, south flank of Baggy Point

6. Steeply sloping vegetated cliffs, Porthleven

a common feature of various parts of Cornwall; they suggested that it might either represent a Newer Pliocene shoreline, or be due to a rounding of the cliff-edge under an arctic climate, for it was not being developed under present conditions. Gullick [1] considered that the explanation lay in these two latter suggestions, for he associated the bevel with a planation, presumably marine, at 180 feet above sea-level. He observed that the bevel was independent of folding but was accentuated in the less resistant rocks. Flett [2] correlated the existence of the slope in the Lizard with the presence of intrusive dykes, leading to a landslipping which breaks down the edge of the cliff.

Challinor [3] discussed what he termed the "coastal slope" in North Cardiganshire. He considered it to be due to subaerial erosion somewhat accelerated by marine erosion of the vertical cliff below. Leach [4] discussed the equivalent "marginal scarp," as he called it, in South Pembrokeshire. He, also, attributed it to a subaerial origin, and thought that its slope was determined largely by the inclination of the cleavage in the thinly bedded strata and by the dip or joint planes in the more massive rocks. The word "bevel," which seems to be the most expressive term hitherto suggested for this feature, was used by Dollar [5] in describing Lundy, where it is locally known as a "siding," "sideling" or "sideland."

In the cliffs now mapped, the bevel occurs in igneous and metamorphic rocks where horizontal jointing provides a foothold for subaerial attack. At the Land's End (Plate 3) the sea has cut a sheer cliff along the vertical joint faces of the granite columns, while the horizontal faces have been weathered to form a series of irregular steps. Debris from above has collected on top of each column to form a more or less concave slope heaped up against the step behind. The general slope on top of the mass of granite columns forms the typical straight or concave bevel conforming to the angle of rest of the material fragmented by subaerial agencies from the rocks above the sea-cut base. Convex bevels are widespread in the metamorphic rocks of the Lizard peninsula. Elsewhere, for instance at Port Isaac (Plate 4), they are found in sedimentary rocks where the coast does not run either parallel or at right angles to marked structural planes.

Like the hog's-back, the bevel often develops locally in the side of a cove which is sheltered from the attack of the sea so that subaerial erosion is there dominant. In any bevelled cliff, the depth of the sea-cut face in proportion to the slope above is dependent on the degree of exposure to the waves. On a sheltered coast, the bevel may occupy the greater part of the cliff height, while on an exposed coast it may be reduced to a shallow curve.

[1] C. F. W. R. Gullick, "A physiographical survey of west Cornwall," *Trans. R. Geol. Soc. Cornwall*, vol. 16, pt. 8 (1936), 380–99.

[2] J. S. Flett, "Geology of the Lizard and Meneage," 2nd ed., *Mem. Geol. Surv.*, 1946.

[3] J. Challinor, "Some coastal features of north Cardiganshire," *Geol. Mag.*, 68 (1931) 111–21; and "A note on convex erosion-slopes, with special reference to north Cardiganshire," *Geography*, 33 (1948) 27–31.

[4] A. L. Leach, "The geology and scenery of Tenby and the south Pembrokeshire coast," *Proc. Geol. Assoc.*, 44 (1933) 187–216.

[5] A. T. J. Dollar, "The Lundy complex: its petrology and tectonics," *Q.J. Geol. Soc.*, 97 (1941) 39–77.

Comparison of marine and subaerial erosion

The angles of hillside slope discussed by Penck [1] have been reconsidered by Wood,[2] who suggests the term *free face* for the sheer face of a hillside which weathers back freely without being subject to the restraint of base-level. This stage of hillside evolution may be equated with the condition of a flat-topped cliff. As soon as the stream is influenced by base-level, the free face begins to be replaced by a slope of talus, accumulating at its angle of rest to form a straight (*constant*) slope which decreases at the foot and becomes a concave (*waning*) slope. So long as the sea is attacking a cliff this condition is never reached. But where the tops of the granite columns at the Land's End (Plate 3) form a small-scale base-level, the angle of the bevel above becomes straight or concave, being equivalent to Wood's constant or waning slope, though it is here above the free face.

When deepening of the valley has ceased, rain-wash and soil-creep become the main agents of erosion and the tops of the valley sides are attacked both from above and below, resulting in a convex slope which Wood terms *waxing*. As Challinor [3] has shown, the convex bevel of a cliff-top is a natural result of marine erosion below and rain-wash and soil-creep above. A free face in a cliff can therefore coexist with a waxing slope above when the strata are being freely eroded.

The age of the cliffs

In North Cornwall, the present sea-cut cliffs have evidently been eroded since the hill-tops were planed to form the latest high-level platform recognized by Balchin. The sea-cut faces are therefore post-Pliocene. Some clue to the relative age of the marine and subaerial portions of the cliffs is afforded by the raised beaches. But as the dates of these and their mutual relationships are still somewhat uncertain, they can only be treated as a very tentative guide.

The Barnstaple Beach, attributed by Arkell [4] to the Riss-Würm interglacial, occurs on Baggy Point (Plate 5) and Morte Point at the foot of the subaerial hog's-back slope, which thus appears not to have been eroded by the sea since the Riss-Würm period. That the hog's-back slopes are old is indicated by the fact that streams flowing over them have been able to carve out valleys for themselves, whereas those flowing over a flat-topped cliff usually descend in a sheer fall.[5] Presumably the entire height of the flat-topped cliffs has been cut back by the sea during the present still-stand.

In the bevelled cliffs, the remains of a raised beach occur only 10 feet above sea-level and the wave-cut face has been eroded above. This beach is now attributed by Arkell to the end of the Riss glacial period, so that where it survives, the sea-cut cliffs had presumably been cut before that time. At Bedruthan Steps near Newquay, the bevel in the headlands ends in a raised

[1] W. Penck, 'Die morphologische Analyse,' Stuttgart, 1924.

[2] A. Wood, "The development of hillside slopes," *Proc. Geol. Assoc.*, 53 (1942) 128–40.

[3] Challinor, *op. cit.*, 1931.

[4] W. J. Arkell, "Three Oxfordshire palaeoliths and their significance for Pleistocene correlation," *Proc. Prehist. Soc.*, new ser., 11 (1945) 20–31.

[5] E. A. N. Arber, *op. cit.*

beach platform, while in the coves the bevel has been worn back to a shallow curve; and in the neighbouring Watergate Bay it disappears entirely in sheer cliffs that have thus been cut since the Riss period. On the other hand, there appears to have been no erosion since that period in the old vegetated slopes of Porthleven (Plate 6) and Coverack, which descend to the 10-foot beach here covered by a thick deposit of "head."

Summary of conclusions

Where sedimentary rocks dip inland and are protected from major wave attack, subaerial erosion is dominant and a hog's-back cliff develops as a long straight escarpment slope above a low wave-cut base. Where the rocks dip steeply seawards, a hog's-back cliff may develop as a subaerial dip-slope. As the rocks in the north of the district dip mainly north or south, and as wave attack comes dominantly from the west, hog's-back cliffs are principally found on north-facing slopes. On the other hand, where marine erosion outstrips subaerial erosion, and where there are no structural planes to control the slope of the cliff, there results a vertical wave-cut cliff with a flat top. Such cliffs usually cut across the dip and strike at high angles and thus face the main wave attack from the west.

Where marine and subaerial erosion are more nearly balanced and where there are no dominant structural planes in the cliffs, a bevelled cliff results, having a vertical wave-cut face below and the normal convex curve of a hill-top eroded by rain-wash and soil-creep above. Where rocks have horizontal joint planes on which scree accumulates, the slope of the bevel, instead of being convex, may be straight or concave, conforming to the angle of rest of the debris.

The sea-cut face of the bevelled cliffs may be tentatively considered to antedate the end of the Riss glaciation; the subaerial hog's-back slopes have not been attacked by the sea since the Riss-Würm interglacial. Active marine erosion has produced the flat-topped cliffs since that period.

OLAUS MAGNUS AND HIS CARTA MARINA: A PROBLEM IN SIXTEENTH-CENTURY CARTOGRAPHY

THE CARTA MARINA OF OLAUS MAGNUS., Venice 1539 and Rome 1572. By EDWARD LYNAM. *Jenkintown: Tall Tree Library*, 1949. 10×7 *inches;* 40 *pages; folding plates.* $6.00

OLAUS MAGNUS' *Carta marina* or map of the countries of northern Europe has long been recognized by students as a landmark in sixteenth-century cartography. Hitherto however no reproduction of it has been readily available to British students. This want has now been adequately met by this publication of the Tall Tree Library, the name by which the cartographic collection of Mr. George H. Beans is known. The monograph by Dr. Edward Lynam is the first detailed commentary upon the map to appear outside Scandinavia.

The publication includes a reduced reproduction of the first woodcut version issued in 1539, a full-scale reproduction of the smaller version, engraved on copper and published by Lafreri in 1572, and seven sections of this second issue, placed conveniently in the text. Only one copy of the 1539 map is now in existence. The 1572 map is almost as rare: seven copies have been traced, of which one is in the Library of the Society.

Olaus' map is enriched by a great number of attractive drawings illustrating the history, folk-lore, and economics of the northern countries. These recall the style of the medieval world maps, but are far more comprehensive and more systematically arranged, and even a cursory glance reveals that the compiler must have been a remarkable man. Dr. Lynam's enthusiastic and sympathetic account of Olaus Magnus' career fully justifies this expectation, and his learned and careful analysis traces out the sources of this material. A good deal of it he shows to be based upon the compiler's experiences on his extensive journeys. The remainder was gathered from his circle of acquaintances, and from wide reading in the existing historians. The result was, indeed, "a contribution to the fame of his country prepared by an exile."

The title "Carta marina" recalls that of the great woodcut map of 1516 by Waldseemüller, also on a plane projection, and decorated, less lavishly, with kings, coats of arms, and animals, but comprising the whole world. Dr. Lynam claims that Olaus' map was "the largest engraved map, though not the largest town-plan, that the world had yet seen." It is however surpassed by Waldseemüller's, which measured 7 feet 9 inches by 4 feet, as against 5 feet 6 inches by 4 feet.

Considered strictly from the cartographic point of view, the map presents several problems, some of which are dealt with below. There can be no doubt, however, as to its advance on earlier maps, *e.g.* Claudius Clavus' map as revised by Dominus Nicholas. Most features of Scandinavian and Baltic geography are for the first time represented with an approach to accuracy. Dr. Lynam analyses the cartographic sources, pointing out that they must include contemporary sea charts, otherwise unknown, probably collected by Olaus on his travels.

It is not surprising that for the next century its influence was widespread largely of course through its re-issue by Lafreri in a more convenient size. The exact extent of this influence and the subsequent history of the two issues are detailed in this monograph.

As Dr. Lynam shows, Olaus was evidently at special pains to consult the best available sources: he was not however always very careful in using them. If, for instance, the degrees indicated in the margin are consulted, it appears at first glance that he believed Iceland to lie north of 80° N., and northern Scandinavia to approach the North Pole. Dr. Lynam in fact characterizes the latitudes as "absurd." Before suggesting an explanation, it is necessary to discuss in some detail the framework of the map.

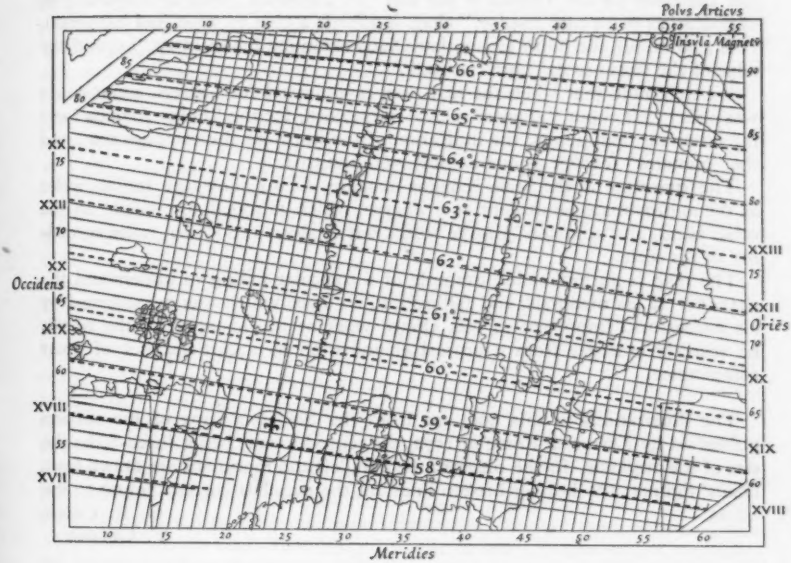
No meridians or parallels are drawn on the map, but the relevant figures are inserted in the margins: in the right and left margins, data relating to the length of the longest days, climates etc. are also included. If the meridians and parallels are inserted, as in the accompanying sketch-map, the net is seen to be oblique to the framework of the map itself. The meridians and parallels are only approximately perpendicular to each other, partly owing to the way in which the margins are divided in the corners.

Dr. Lynam considers that the meridians are magnetic, the network being oriented to a point east of true north, and that the magnetic pole is indicated by a legendary island. There are, however, several reasons for thinking that the

GRVNTLANDIE PARS
HVITSARK
ISLANDIA
GRVNTLANDIE PARS
NORMOBIA
MEGALANOIA
FARE
TILE

OCEANVS SCITHICVS
FINMARCHIA
SCRICFINNIA
BIARMIA
LAPPIA OCCIDENTALIS
LAPPIA ORIENTALIS
MARE BOTHICVM
BOTHNIA OCCIDENTALE
BOTHNIA
CARELIA
LACVS ALBVS

meridians are geographical. Dr. Lynam states that "since meridians drawn through the Pole and the *Insula* prove to be parallel, his network is oriented to a Magnetic Pole lying either 10° 45′ or 12° east of the vertical." But the meridian "49" passes through both the "Pole" and the magnetic island, and the meridians are also parallel, so that it cannot be said that they are aligned on the island or on the pole any more than on any other feature of the map. Further, as will be seen presently, the parallel marked 90 must be the Arctic Circle: the network of which it is a part is therefore geographical, and the position of the "Pole" relative to the network is only approximately indicated. On contemporary sea charts also, the oblique meridian indicated the true north. As regards the angle of approximately 12° between the meridians and the vertical, Dr. Lynam points out that the magnetic variation in the Baltic was then about 12° E. It is interesting to note that if Olaus was attempting to allow



for this, he has made the correction in the wrong direction for the eastern portion of his map—assuming the meridians to be geographical. The hours of the longest days are marked, somewhat carelessly, in the borders, from "*Hore XVII*" to "*Hore XXIII*" (*XXI* is omitted apparently by error, and on the left-hand scale *XX* is written in place of *XXIII*). "*XVIII*" is fairly correctly placed in latitude 58½°, instead of 58¼°. "*XXIV*" is not inserted, but would fall near the parallel marked 90. Now *XXIV* (the parallel on which the longest day is 24 hours) corresponds to the Arctic Circle, 66½° N., and not the pole. If we trace this parallel across the map we find that in fact it lies in approximately the same relationship to Iceland and northern Scandinavia as does the Arctic Circle. The highest parallel on the map should therefore be marked 66½, not 90.

Accepting this correction as justified, and dividing the space between *XVIII* (58½°) and the uppermost parallel into eight equal divisions (66½–58½), *i.e.*

of 1° each, we obtain some surprising results for latitudes of places in the northern portions of the map: for example N.W. Island 66° (actual lat. 66°), Central Iceland 65° (65°), Faeroes 62° (62°), northern end of Gulf of Bothnia 65° (66°), southern Aaland islands 60° (60°), Soderala 61° (61° 15′).

It is clear therefore that Olaus made the grave error of numbering the Arctic Circle as 90 instead of 66½, as it must have been on the original he was using. It is further of interest to note that, if the adjusted parallels are considered, fairly considerable discrepancies occur for places in the Baltic, ranging up to 2½°. This suggests that Olaus fitted together two maps rather unskilfully.

It seems clear therefore that the basis of the map was one with the hours of the longest days and probably latitudes also, marked in the border, but that in preparing his map Olaus copied the "hours," but made a serious error in numbering his parallels through marking the Arctic Circle as 90°. It is hardly just therefore for Dr. Lynam to say that "its Ptolemaic framework appears on examination to be idle display," since it affords a clue to what had happened. It is also beside the point to say that Olaus extended his country "beyond the edge of the world to 92° north latitude."

We may note that when the map was re-engraved for Lafreri, some doubt was clearly felt about the geographical framework, for the "Polus Articus" and the other cardinal points, the indication of the north on the compass rose, and the "climates" (except in one corner) were omitted.

The question of the scale remains obscure. Olaus shows 30 Italian miles as the approximate equivalent of a degree, which is much too small: on the other hand, an "adjusted" degree works out at about 120 Italian miles according to his scale.

The map is an interesting example of a compiler failing to understand the character of his materials, and falling into an error which was perpetuated by his successors. Important as was Olaus' work as the historian of the north, he scarcely emerges from a critical examination as a cartographer of great competence.

The illustrations to this note are from the Society's copy of the version published by Lafreri at Rome in 1572, the reproductions being three-fifths the size of the originals. In the diagram the parallels and meridians are drawn from Olaus' figures; the heavier broken lines are the parallels corresponding to the hours

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REVIEWS

EUROPE

THE TOPOGRAPHY OF ROMAN SCOTLAND NORTH OF THE Antonine Wall. By O. G. S. CRAWFORD. *Cambridge: University Press*, 1949. 10×7½ *inches;* xii+162 *pages and plates; map and diagrams.* 25*s*

This account of Mr. Crawford's field survey of Roman sites in Scotland north of the Antonine frontier at various times up to 1942 was first presented as the Rhind Lectures at Edinburgh.

Knowledge of the Roman occupation of this part of Scotland depends very largely upon archaeological evidence, and the discovery and planning of visible remains of the Roman period has engaged the attention of many archaeologists since the first large-scale maps of Scotland were prepared by General Roy in the mid-eighteenth century. Mr. Crawford outlines, in an introductory chapter, the general character of Roman military works and he then describes in order all the known sites, working northwards from the Antonine Wall. The evidence of excavations is used to the full, and the author has added a new means of research, not available to earlier archaeologists, namely, air reconnaissance.

The ancient geography of the area clearly shown on the end-paper maps is exceptionally interesting, affording considerable insight into Roman strategy. The sites lie within the north part of the Midland Valley of Scotland, between the edge of the Highlands and the sea, and extend northwards from Stonehaven towards Buchan. Temporary works normally precede consolidation and Mr. Crawford's account assumes that the great marching-camps were constructed by Agricola's army advancing along Strathmore. After the defeat of the natives in battle at Mons Graupius, which Mr. Crawford identifies with Raedykes, part of the occupied territory was consolidated. The Roman plan was to construct a road through Strathmore guarded by forts at important river-crossings, while forts blocking the mouths of the main valleys were intended to prevent incursions from the Highlands. A 50-acre legionary fortress at Inchtuthil occupies a central place in the system. The positions of the forts imply a thorough knowledge of local geography. Roman reconnaissance parties must have penetrated some of the Highland glens and have climbed to mountain-tops, before so well organized a scheme could have been devised. In spite of such careful planning, the Roman hold on the country was not undisturbed. At Inchtuthil at least, there was more than one phase in permanent structures within the Flavian period, showing that reorganization had taken place, before a general withdrawal some time after Agricola's recall. Less is known of the history of the area in the second century and how many of the forts were reoccupied as outposts to the Antonine Wall, excavation has yet to reveal.

Mr. Crawford's volume is the first general description of the Roman topography of this area to appear since the time of Roy. His admirably clear account is based upon notes written in the field, and most of the sites he describes are illustrated by diagrams. The book is invaluable to all who are concerned with the study of Roman Scotland. K. ST.J.

STUDIES IN REGIONAL PLANNING. By G. H. J. DAYSH and others. *London: George Philip*, 1949. 10×6 *inches;* xxiv+223 *pages; maps.* 25*s*

Within the last five or six years a number of geographers took up appointments as research officers, regional planning officers, maps officers and so forth in

connection with the Ministry of Town and Country Planning and its Scottish counterpart. Most of them have returned to University work with ripened experience and a store of knowledge which in part finds expression in this book of Planning Studies. Professor Daysh, as both editor and contributor, could also draw upon his pre-war researches and experience in connection with the Development Areas of West Cumberland and the North-Eastern Industrial Region. The various contributions have been fitted into the scheme of Regional Survey for Planning which was outlined in a paper read to the Society by Professor Daysh and Mr. A. C. O'Dell in 1946, a device which makes for easy reference rather than for really enjoyable reading. Two chapters embracing five counties in the west and south-west of England are contributed by Mr. A. A. L. Caesar, who also shares responsibility for the North-East of England with Professor Daysh. The latter writes on Cumberland, and Professor K. C. Edwards on the East Midlands. Dr. Arthur Geddes and Mr. O'Dell, assisted by Messrs. Spaven and Houston cover between them the Highlands and Isles and Central Scotland. It will be seen therefore that Lancastria, Yorkshire, the West Midlands, Wales, and the greater part of South-East England are not dealt with. A series of excellent maps, mostly on a scale of 10 miles to an inch, forms an important feature of the book. These have been executed by George Philip and Son, Ltd., and consist of coloured over-prints on an Ordnance Survey physical base-map. The features selected for mapping are, of course, those that must influence the preparation of a plan for the particular region. In the East Midlands for example, we have the coal-fields, differentiated as exposed, concealed (exploited) and concealed (proved or probable); the iron-stone and gypsum areas; the really first-class farmland (chiefly in the Fens); the areas of outstanding " amenity "; the centres of rapid expansion of population; the trunk and first-class roads; and finally (looking into the future), the centres which might take up the so-called " over-spill " from Sheffield (itself outside the Region), and the proposed new trunk roads, chiefly necessary for improving communications between east and west. In Devon–Cornwall Mr. Caesar marks a proposed motor highway by-passing Exeter, and running down the central-axis of the peninsula to the Redruth–Camborne district. This is distinguished as a priority area for additional employment, and is of course, handicapped by its great distance from the industrial heart of England. Moreover it has no attractions as a holiday centre or residential centre both of which "uses" are favoured, although only up to a point, by such relative isolation. Isolation of a much more extreme character, and the wide dispersal of very meagre resources, are the factors which are necessarily dwelt upon by the writers on the Highlands. Their map, too, has to be over-printed for depopulation, while any centre with over seven thousand people is designated a "large town." Expansion based on industry is suggested near Fort William, at Invergordon, and at a village on the north-west coast of Lewis. Is this realistic? Dr. Geddes is charmed with the primitive simplicity of crofter life, but he admits that many millions of pounds have poured annually into the region in the shape of subsidies, direct and indirect. The tent life of the Bedouin, and the virile nomad character have great attractions for many people (although they would not bring up their own children to become nomads), but already in many parts of Asia the nomad has become sedentary. Should he be subsidized to continue picturesquely to wander? It is impossible to escape from the implications of Blackpool, of Brighton, of the Butlin camps. Crowds attract. The tourist appeal of the Highland solitudes must remain limited, and its agricultural productivity slender. Mr. O'Dell in discussing Central Scotland is more forthright—not afraid, even, to see no point in the darling project of

the Forth–Clyde ship canal. As he says, planning or no planning, the shift in emphasis of coal-mining from Lanarkshire to Fife will have its effects. Lives will be dislocated. But planning can ease the dislocation; and best of all by making a natural spontaneous migration easy. A generation is growing up which has never seen a board bearing the simple notice "To Let."

All the regions studied have their distinctive problems, but it is interesting to note how fundamental "accessibility" is to them all. The very estuaries, which we have been taught to cherish, as bringing seaways into the heart of Britain, are isolating factors, delaying factors, when we are considering movement athwart them. We must tunnel under the Thames, the Mersey, the Humber; bridge farther downstream the Severn or the Forth. The circuitous journey to the head of tideway is no longer tolerable.

Professor Daysh's Preface to these studies deserves careful reading. He sets out, and not for the first time, the dangers and indeed the stupidities of uncoordinated and piece-meal planning. Yet the rigid administrative framework within which planning powers exist and are exercised makes piece-meal planning inevitable. The geographer makes no claim to usurp the function of the planner, but he does claim to be a useful member of a planning team in so far as his training leads him to visualize a region as an organic whole. Durham cannot formulate a plan that takes no account of Northumberland, nor Yorkshire one that takes no account of Durham: Tyneside and Teeside are geographical units. A decision made in the County of London is likely to "make ripples across the lives" (to borrow a striking expression of Mr. O'Dell's) of almost every one in Surrey, or perhaps in Essex. Planning without clear vision of the consequences is more dangerous than *laissez-faire*. E. G. R. T.

AN ECONOMIC GEOGRAPHY OF GREAT BRITAIN. By WILFRED SMITH. *London: Methuen*, 1949. $8\frac{3}{4} \times 5\frac{1}{2}$ *inches;* xv+747 *pages; maps and diagrams.* £1 12*s* 6*d*

It is pleasant to record the publication of a work on the economic geography of Great Britain, which is likely to rank as one of the standard geographical textbooks on this country. It forms a very welcome addition to the sadly limited number of outstanding books on our geography, and we are indebted to Mr. Wilfred Smith for a scholarly and well documented book which includes much original work.

The first part of the book (pages 3–170) is a summary of the antecedents of current economic geography with special reference to the "immediate antecedents, that is, the transformation of the medieval into the modern economy." It illustrates admirably the author's claim that "Economic Geography is not static, though it has its relatively static elements, but dynamic." Yet at the same time it brings out just as forcibly the close relationship of economic geography to economic history, an aspect which is further accentuated by the method of treatment employed in the second part. The dynamic qualities of Geography are presumably now accepted by the majority of geographers, but in economic geography it is surely in regard to the recent past, rather than to more distant times, that these qualities should be emphasized. The second part (pages 173–698) is a systematic analysis, item by item, of the present economic geography of the country. First to be considered is farming, one chapter being devoted to arable and one to grass farming. The method of treatment is firstly to block out the major forms of land use and to discuss the factors affecting their distribution, and secondly to survey the present-day agricultural geography region by region. The result is a very readable account of the farming of Great Britain. The concentration of the bulk of the agricultural statistics in two

appendixes has no doubt much to do with this, and a policy of less reliance on the interpretation of a mass of statistics interspersed throughout the text might have done much to simplify the description of other activities. The chapters on coal-mining and iron and steel manufacture are notable for their detailed regional analyses. Under engineering, special attention is paid to agricultural, locomotive and textile engineering, the ship-building, motor vehicle and aircraft industries, and electrical engineering. In this chapter however a tendency to argue the obvious is most marked. The descriptions of the textile industries are some of the most felicitous of all as befits an author writing in the North of England. Especially welcome is the attempt made to assess the influence of relative humidity and water hardness on the distribution of certain textile industries. The manufacture of clothing, the leather and boot and shoe manufacture, and milling and baking are the remaining industries discussed, and Mr. Smith has much that is interesting and new to say about each. The concluding chapters consider inland and ocean transport, and foreign trade and the British economy. Here the discussion on the differences between road, rail and canals as means of transport is particularly useful and the consideration of freight rates from a geographical standpoint is most illuminating. Several inaccuracies occur in reference to inland transport, but the general freedom from obviously disputable points in a text of close on 700 pages packed with information is one of the most remarkable features of this book.

The problem of obtaining up-to-date statistics and keeping abreast of modern developments is now one of the economic geographer's greatest difficulties. Bearing this problem in mind it is still somewhat unfortunate that a greater degree of uniformity in the accounts of different industries could not have been achieved. In broad terms the description of coal-mining is only carried down to 1945 and but brief reference is made to nationalization; the iron and steel industry is mainly concerned with pre-war conditions illustrated by the year 1935 and little subsequent to 1945 is mentioned; ship-building stops short at 1939, and the motor vehicle industry mainly before the second world war; comparatively little is said about wool textile manufactures since 1943 and the account is mainly concerned with conditions before 1939; cotton manufacture is brought down to 1947 and clothing to 1937, the relevant 'Working Party Reports' being considered in both instances. Further evidence of this lack of uniformity, admittedly very difficult to avoid, could be submitted, but most surprising of all in a work first published in 1949 is a reference to developments in engineering "immediately preceding the present war."

The value of the book is greatly enhanced by about 100 maps and diagrams, which, with the exception of some illustrating the first part, are on the whole admirably clear and well designed both to amplify and clarify the text.

F. R. G.

BRITAIN'S GREEN MANTLE. By A. G. TANSLEY. *London: Allen and Unwin*, 1949. 9×6 *inches;* xii+294 *pages; diagrams and illustrations.* 18*s*

The perils to which we were exposed during the war very naturally made us more conscious of the ties of affection and history that bind us to the land on which we live, and one result has been a great growth of interest in nearly all branches of "natural history." In consequence there has been a veritable flood of books of almost every sort, and on almost every aspect of the subject, and it is becoming increasingly important to sift the grain from the chaff.

Professor Tansley's latest book is certainly one of the more considerable grains and will endure long after much of the chaff has blown away, as indeed is only its due, since it is by one of the pioneers of the subject, to which he has

devoted much of a long life, and written with all the felicity of phrase and style that we have learnt to expect from him.

As its author says, 'Britain's Green Mantle' is intended for all who want to know more about our native vegetation, and it is admittedly a condensation of his much larger work 'The British Islands and their vegetation.' It begins with a historical review in two chapters which are all too short, and there are two more on the climatic, edaphic and biologic factors that control vegetation, but the bulk of the book is an account of the different kinds of more or less natural vegetation which are to be found in these islands. The chief difficulty in writing a cursive account of this kind is to maintain a proper balance between its different parts and here there is little room for criticism on that score. On the contrary one welcomes such features as the lifting of the emphasis on woodland, which though scientifically of great interest is certainly not the most generally striking kind of vegetation, and the increased stress laid on the part that grassland has played, and must continue to play, in the national scene. It is inevitable when one loves the countryside, that any book about it must in itself be a plea for its preservation, but Professor Tansley presses this point home by drawing attention not only to the more obvious dangers of spreading industrialism but also to the more subtle ones arising from selfish exploitation, bad planning and muddled policies.

But the value of the book does not end here. It is said in the tail of the preface that "long and wearisome lists of species" have been avoided, and one cannot help wondering whether this may not be the chief reason why the author has succeeded also (is it fair to say, in this particular case, incidentally?) in producing a first-rate textbook of that side of plant geography that is called ecology. As an introduction to this subject his book is one which no student of botany, whether academic or amateur, can afford to neglect.

All this being so it must be admitted that the many photographic illustrations fail in general to reach the standard that the letterpress deserves, and raise very obviously the problem of how best a book on plant ecology may be illustrated. Some of the pictures are satisfactory enough, and the fact that many of these (such as those from *The Times*) are not primarily scientific pictures makes one consider whether the use of carefully selected landscape photographs, supplemented perhaps by reproductions of paintings, may not be a better means than the use of deliberately botanical photographs not so suitable for reproduction and in which, to use a peculiarly apposite phrase, it is often difficult to see the wood for the trees.

Apart from the weaker photographs the book is well produced, the paper pleases, the type is extremely clear, and the green binding is both agreeable and dignified. R. G.

ENGLISH PLACE-NAMES. By H. G. Stokes. *London: Batsford*, 1948. 9×6 *inches;* viii+120 *pages; illustrations.* 12*s* 6*d*

As a hunter of curious names and an exponent of their meaning, Mr. Stokes is a very alert and entertaining author. In this book he has assembled about a thousand of the more fanciful English place-names, largely by collecting them in the field, and has given the results of his attempts to discover their origin. Some of them baffled him, but without diminishing his pleasure in the investigation. It is an easy book to use. A good index leads straight to every name which has been seriously considered. A list of authoritative works on English place-names puts the amateur into touch with the right sources of information, and a glossary of the commoner elements which occur in the names gives him a key to the understanding of many names not considered by Mr. Stokes. It should

all serve to encourage intelligent, popular interest in the subject. To the amateur however a warning is necessary. Toponymists are no longer satisfied with plausible explanations of difficult place-names, and the right results do not necessarily follow from the use of dictionaries and glossaries. Students of European place-names are now extremely critical of methods which have hitherto been thought satisfactory, and they demand that the history of each name be traced before any conclusions are drawn about its derivation. M. A.

GÉOGRAPHIE UNIVERSELLE DES TRANSPORTS. Tome I, Géographie des chemins de fer français. 2nd vol. By H. LARTILLEUX. *Paris: Librairie Chaix*, 1948. $11\frac{1}{2} \times 8$ *inches; 253 pages; maps, diagrams and illustrations.* £2 11*s*

The first volume of the Géographie Universelle des Transports was reviewed in the *Journal* two years ago (109 (1947) 237–9). The second volume is a worthy successor, though its scope and general interest are perhaps less. It deals with all the miscellaneous railways and allied forms of transport in France—the "chemins de fer secondaires," the Paris "Métro," urban tramway and trolleybus systems, and the curious but often spectacular transport media of the high mountain areas (rack railways, funiculars and telpher lines)—in other words, all forms of transport which are tied to a line, be it rail, wire or cable. The present moment finds much of this transport in a state of transition, partly owing to wartime destruction and lack of maintenance, and partly because the relative advantages of the various forms of transport other than main-line railways, operate differently in different parts of France. On the whole, "secondary railways" are on the decline. These lines reached a maximum of over 20,000 kilometres in the 1920s, and they were always far more important in France than in Britain. The competition of road services, and wartime neglect, have left many of them in very bad shape. A considerable mileage has been abandoned or confined to goods traffic; but the lines which remain are by no means moribund and much modernization is in progress, especially of permanent way and rolling stock, whilst electrification has in many cases made them of more value than ever before. As for the urban tramways, they are either being modernized or are being replaced by trolleybuses; while the Paris Métro, like the London "tube," is extending its tentacles farther and farther into the suburbs. In the mountains, there is a tendency for new developments to take the form of telpher lines rather than the old-fashioned rack-railways (crémaillère) which are expensive to construct and to maintain and are slow in operation.

As in volume 1, there is a vast amount of illustration, including coloured maps, over 150 black-and-white maps and diagrams, all beautifully executed, and hundreds of photographs, many of which, especially of the rack-railways and telpher lines, are very fine indeed. S. H. B.

RESUMEN FISIOGRAFICO DE LA PENINSULA IBERICA. By J. DANTÍN CERECEDA. *Madrid: Consejo Superior de Investigaciones Cientificas*, 1948. $8\frac{1}{2} \times 6$ *inches; 309 pages; diagrams and illustrations*

This reprint of a work published originally in 1912 is intended primarily as a memorial of its author, the Spanish geographer Dantín Cereceda (1881–1943), and it is of interest also as a landmark in the history of geographical studies in Spain. Based solidly on the geology and tectonics of its period—the special importance to the geographer of Spanish tectonics had been recognized already by Fischer (1894)—it extends the content of Physiography beyond climate, flora and fauna to Agriculture and Ethnology, and closes with a glance towards

a promised land of Regional Geography. Death came upon the author while he was making a second excursion into this land (*Geogr. J.* 104 (1944) 53).

The hesitation felt in associating Dantín's name with any re-written chapter on the tectonics is intelligible, but anyone who considers the great advance made since 1912 in the topographical and geological mapping of Spain and in the recording of rainfall and river flows, besides the changed modern approach to tectonic questions, will share the regret of the reviewer that this reprint should be described as a "second edition." R. A.

ASIA

ARMED PILGRIMAGE. By J. V. DAVIDSON-HOUSTON. *London: Robert Hale*, 1949. 9×6 *inches;* 313 *pages; illustrations.* 15*s*

For twenty years Colonel Davidson-Houston has devoted his time to the ingathering of knowledge about the peoples of the world; he had an aptitude for foreign languages that made him an inevitable choice for Intelligence work. 'Armed Pilgrimage' is the testament of his journeys and contacts. It is superficial mostly, which is surprising from such a source, but amusingly written and interesting to read. We wonder, occasionally, if all Roumanian soldiers are stupid yokels; or if the Russians ever eat anything but caviare, or drink anything except vodka, but the impressions we get are very realistic. It seemed to disappoint the author considerably when German customs officers did not turn out to be as Nazi as he expected, and he also seems to have been surrounded in a blanket of pro-British elements in Roumania while the policy of the country went against us. But it is easier, I imagine, to enter into the idiom of a people than to appreciate the historical background. In 1938, the author visited Vladivostok and was the first British officer to do so since the Revolution. Again we are disappointed. Possibly he has treated us to a superficial account and reserved the details for those who conduct our defences and look to our security. We certainly hope so. The only impression we get from the book is a port that is dirty and drab and inhabited by a poverty-stricken population. There is an amusing spotlight on the jealousy between the Japanese and the Russians. There are also the celebrations in Japan, and the claims of Russia, to a great victory in one of their frontier incidents. Both sides, it appears, won the battle. Japan, Inner Mongolia, Manchuria, China, Roumania, Palestine, and Persia are only part of the story and it would be impossible to cover so much territory without making something worth reading out of it all. There are narrow escapes from death, of course, but they appear to be sadly underwritten or else we are becoming too much accustomed to the more violent heroics that some writers excel in. When the author takes time to notice the beauty of his surroundings, he is at his best. A. S. J.

BURMA'S ICY MOUNTAINS. By F. KINGDON-WARD. *London: Jonathan Cape*, 1949. 8×5½ *inches;* 278 *pages; sketch-maps and illustrations.* 15*s*

This book records two journeys made before the outbreak of war and adds another chapter to the long story of Mr. Kingdon-Ward's wanderings on the borders of India, China and Tibet. The author warns us to skip Chapter Eleven if we are not interested in plants and all they stand for, but indeed all the chapters pre-suppose both an interest in botany and a familiarity with botanical names which may well deter the general reader. But he has a tale to tell, of lonely marches in the Nam Tamai valley and often foiled attempts to approach even the foot of Ka Kapo Razi, the 19,269-foot peak that crowns the Irrawaddy–Brahmaputra divide; and as a botanist his eye lights on points of ecology and

plant distribution that are common ground to the geographer. This border region of tropical and temperate floras provides abundant matter for comment on the post-glacial mingling of species in an area where altitude furnishes a striking local differentiation of climatic zones. There is perhaps a confusion of thought in the suggestion (p. 189) that, with the glaciation of the Burmese mountains, congestion "must have ensued amongst the refugee population, as the highland flora fled southwards . . . to get away from the clutching hand of death," but it is an interesting surmise "that the epiphytic habit may have been developed to enable certain plants to survive in a changing climate " (p. 188). If the author sometimes fails to distinguish between glacial erosion and the longer run of Tertiary planation and the development of the drainage system, he recognizes the many marks of an extensive glaciation in the landscape of northern Burma.

The last eight chapters relate to the Vernay-Cutting expedition in the mountains of the Burma–China frontier some hundred miles farther to the south. The reader is left with the impression that Mr. Kingdon-Ward would have covered more ground had he been alone and unfettered by an organization; but there are the same illuminating comments on plants, landscapes and people, and a freshness in his appreciation of the activities of specialists in other subjects than his own. Readers of his earlier books will welcome again the apt phase and vivid simile that make his descriptions come alive.

The book is not free from misprints and though the mountains are icy enough they do not provide it with a very apt title. F. G.

AFRICA

THE NEW CONGO. By Tom Marvel. *London: Macdonald,* 1949. 9×6 *inches;* 349 *pages; sketch-maps and illustrations.* 15*s*

RUMBLE OF A DISTANT DRUM. By Mary L. Jobe Akeley. *London: Harrap,* 1948. 9×6 *inches;* 271 *pages; illustrations.* 10*s* 6*d*

'The New Congo' is an exceptionally able and useful book for the enlightenment of a sadly out-of-date public opinion, and in fairness to the Belgian nation, it needed to be written. Any attempt to combine the living richness of an exotic travel-tale with the statistical austerity of a guide book tends often to give a disjointed picture. Here, by a *tour-de-force,* the combination of the two, in wildly contrasting country containing scores of very diverse and nascent nations, presents a harmonious tableau. The book has fewer inaccuracies than confessed omissions. There is omission, in the bibliography, of Louis Franck's classic 'Belgian Congo,' to which forty experts gave their aid.

It is mainly a fair and fascinating account of the economic development by Europeans of the heart of the African tropics. The author does not deal in hypocrisy. When he comes to discuss the undoubtedly almost-model material conditions created by Belgians for African workmen and artisans, "Certainly," he observes, "it was bootless to speculate that any obscure charitable urge motivated Geomines' native policy. The reason lay in two words: 'it pays'." More fairly, if in apparent afterthought, he shows that "The management was committed to a policy of native welfare under the Colonial Charter of 1908." He might, more fairly still, have added a word of the general determination of the average Belgian, as of the average Englishman, that colonial populations shall receive a fair deal. Everywhere, on the author's journey, he has conscientiously consulted the Belgian heads of Belgian industrial enterprises, with remarkable and accurate results. On his excellent penultimate page, he very

properly points out that "In all this, we have not mentioned the vast majority of the Congolese . . . the millions of natives living in their thousands of interior villages, with little or no contact with the Whites, save for occasional doctors or missionaries. They comprise between three-fourths and four-fifths of the total population. The casual visitor seldom sees them. Articles and books are seldom written about them." In such a book, it would be unfair for a reviewer not to observe that a comparable book on, say, The New Morocco, The New Malaya, or The New Estonia could not properly be regarded as a full and balanced picture without some consultation with the people themselves.

In contradistinction to its only compeer the Amazon, which is navigable by ocean-going ships for over 1000 miles from its mouth, the Congo has an open seaway for only 3 per cent. of its length. The marginal Monts de Cristal barred the way to early exploration from the sea. On page 19, the author quotes, with great effect, the foresight and discernment of the British Admiralty orders to Captain J. H. Tuckey for the exploration of the Congo river as early as 1816. Their Lordships foresaw the almost unique utility of the Congo in over 1000 miles of uninterrupted perennial water-transport: "It must be supplied by large branches flowing from different, and probably opposite, directions, so that one or more of them must at all times of the year pass through country where the rains prevail."

And what of this new Congo's future? The author has a saving sense of perspective and perceives the lack of any stabilizing balance in such sudden and large-scale industrialization of backward peasant-populations. "There remains (he observes on page 261) another effect of mechanization, perhaps in the long run the most significant of all. It is creating out of raw material a skilled industrial working-class. Congo workers . . . are fitting into the pattern of *The New Congo*. They are the stuff of which *The New Congo* is made." For a humanly-expanding New Africa, in its relation to the diminished Western-world of Old Europe, the foreseeable problem is essentially one of Human Geography in which history, including 'The New Congo,' has already revealed some of the physical, but few of the spiritual, effects of environment on African humanity, in a society now exposed to a more profound and alien revolution of ideas and ways of life than was presented even by the French and Russian revolutions. History and Human Geography can inform us of the possibilities, and even of the probabilities, of our own prospects, unless these sciences can help Europeans better to understand Africans—"let proconsuls take heed."

Finally, there is a brief and interesting account of the new and valuable development, by the Belgian Institute of African National Parks, of coordinated Scientific Research in the three National Parks near the respective borders of the Sudan, Uganda and Rhodesia. The author pays well-deserved tribute to his eminent compatriot, the late Carl Akeley, and to his efforts to establish a gorilla-sanctuary in the East Congo mountains.

The author of 'Rumble of a distant drum,' on an adjoining part of Africa, is also an American, the widow of Carl Akeley, whose classic elephant-group *The Stricken Comrade* is his American monument and whose grave is the point of tragedy and the point of re-departure for the dual journey the book describes. The wide range of the Odysseys of the authoress, her husband and her African helper-hero is a dedication to the spirit of Africa itself. It conveys for a general public, mainly American, the most romantic side of Africa—and of Africans. The book's inspiration springs from the living memory of a magnanimous man, then technically unique in his own field, and from the high courage that was Carl Akeley. Within this rather complex framework there is enclosed, sometimes

difficult to disentangle, a wealth of interesting information on Man, Bird and Beast. The present reviewer was a happy companion of the authoress and her husband on the longer part of his last journey. He remembers, as a *voix-d'outre-tombe*, his parting remark, "I should be content to die and be buried on those high Rift mountains which we love so well." There indeed he was to die, and there is his tomb to-day. T. P.

NORTH AMERICA

COPY-BOOK OF LETTERS OUTWARD, 1680–1687. Ed. by E. E. RICH, with an introduction by E. G. R. TAYLOR. (*Publns. Hudson's Bay Record Soc.*, XI.) *London*, 1948. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* xlii+416 *pages; plates*

This volume includes the instructions issued by the Committee of the Hudson's Bay Company in London to their servants in the Bay, and petitions to the Crown concerning the incursions and depredations of the French. By the Treaty of 1686, the claims and counterclaims were to be adjusted by mutual agreement. One question at issue was the bounds of the Company's monopoly, which was also frequently in dispute in London. Contemporary maps might be expected to provide some evidence on this point, and the editor of this series has therefore entrusted the introduction to a geographer. Professor Taylor has made good use of the opportunity, and her essay is of wider interest than is suggested by the title of the volume.

By a critical examination of contemporary cartography, she illuminates several obscure points, including the various interpretations of the term "Hudson's Bay." This was frequently applied to what is now James Bay; this again was erroneously divided by a long peninsula into East and West Hudson's Bay, and, to increase the confusion, it was sometimes applied also to the bay otherwise known as the "Bay of Hudson's wintering," located at the northern end of this peninsula. The Company's servants regarded the Bay as beginning at Charlton Island, and the whole of this area was often referred to as the "bottom of the Bay." The stages by which a relatively correct representation of the area was reached are set out lucidly, with reproductions of contemporary maps and charts. Professor Taylor has some useful comments of general application on the merits and demerits of chart makers, cosmographers (working in their studies) and the irresponsible purveyors of cheap maps for the public.

Her second object is to gather into a coherent whole all the geographical data contained in the printed documents, and to relate the life and actions of the garrisons of the Company's "forts" to this background. To them, the environment was hostile, and the potentialities of the region, except as a producer of furs, negligible. It was only slowly, and with the example of the French before them, that they adopted a bolder attitude. Professor Taylor comments that early venturers uniformly failed to appreciate the potentialities of new lands in unfamiliar environments, citing the example of Australia. Tropical areas however excited extravagant ideas of their wealth, and this contrasted attitude may in part have been the lingering effect of the old theory which regarded the tropics as the seat of the world's treasure, and the Arctic as an inhospitable land of darkness. It would appear to-day that an almost diametrically opposed view is held in some quarters. G. R. C.

CALIFORNIA PLACE NAMES: a geographical dictionary. By ERWIN G. GUDDE. *Berkeley: University of California Press* (*Cambridge: University Press*), 1949. 11×8 *inches;* xxviii+431 *pages.* £2 15*s*

This book contains less than its appearance would lead one to suppose, for it deals only with about four thousand names. It makes no pretence of being a

gazetteer of California but has, for its sub-title, "a geographical dictionary." One has only to examine a few pages of the body of the book however to discover that it is more than that. It is, in fact, a toponymic study of considerable importance. The pronunciation of every name is given, in the conventional alphabet made familiar to Americans by Webster's "Collegiate Dictionary"; and the history of each name has been carefully traced as far as possible through published records and through unpublished documents preserved in private hands and in the archives of the state. Many names are traced right back to the deeds of grants made under Spanish or Mexican rule. A considerable number of the names investigated are what the French call *noms de lieux-dits*, names of uninhabited pieces of ground; and certain Spanish names prove to be translations of still older Indian names of the places to which they now apply. Many of the entries make most entertaining reading, and their authority seems to be final. This alone makes the book indispensable in Californian geography. The greater is the pity that the binding, title-page and typographical preliminaries are out of keeping with the plain excellence of the average page.

M. A.

RURAL MEXICO. By NATHAN L. WHETTEN. *University of Chicago Press*, 1948. xxv+671 *pages*; $9\frac{3}{4}\times7$ *inches; maps, diagrams and illustrations.* £2 15*s*

This book has been written primarily with a view to giving United States readers a better understanding of their southern neighbour; but, although it is overloaded with statistics, there are chapters that will interest English readers. The author spent most of his childhood in Mexico, and from 1942 to 1945 he served as rural sociologist attached to the United States Embassy there. He has produced a monumental compilation based on a formidable bibliography, but it is disappointing to find that, in spite of his undoubtedly wide knowledge of the country, he has not made more discriminating and critical use of his material. Although he has chosen rural Mexico as his subject, he has not been able to produce an altogether satisfactory definition of "rurality" (p. 36), and it was perhaps inevitable that he should range beyond the scope of his title. We may accept his statement that "Mexico is still overwhelmingly rural in character" (p. 39); but it is confusing to be told on page 34 that "about two-thirds of the total inhabitants of Mexico may be designated as rural" and on page 36 that "roughly two-thirds of the total economically active population are engaged in agriculture"; and it is astonishing to find on page 39 the meiosis that Mexico City—with one and a half million inhabitants—is a "definite sign of urbanization."

There are some informative chapters on the Ejido System of land tenure and on the life and customs of the peasants, though these would have been more interesting to the general reader if the author had drawn more on his personal experience. But it is difficult to reconcile with the fact that so large a proportion of the nation is rural the statement, in Chapter 1 on "The Geographical Environment," that "Rural Mexico is geographically and culturally isolated from the general life of the nation." The author, coming from one of the most advanced nations in the world, seems to have been unduly impressed by the ignorance and isolation of the majority of the population of Mexico, and he is not quite fair to them in this respect. Communications at least have been developed more quickly than he implies. He does not mention the network of air-routes planned for the whole country about twenty years ago, and he appears to overlook the fact that the highway from Mexico City to Acapulco, which he says (p. 15) was completed in 1940, was passable long before then.

The reviewer covered this route comfortably in a small motor car four times in 1930.

In view of the author's opinion of the backwardness and isolation of the majority of the people, it is difficult to account for his apparent faith in the numerous statistics that he has so painstakingly collected. There are more than ninety statistical tables scattered through the text and forty-one additional tables in Appendix A, numbered in a separate series. Such tables may be of value to a rural sociologist, provided that they are kept up to date, but a reader who is trying to obtain a picture of rural life in Mexico is likely to discount their value when he reads, for instance, in Table 64 (p. 317), that in 1940, out of a total population of 19,653,552, precisely 9,790,349 wore shoes, 4,629,959 wore sandals, and the rest went barefooted. Even an exporter of footwear would be satisfied to know that rather more than a quarter of the population go unshod.

For the English reader perhaps the most interesting question examined by the author is how far the process known as the Mexican Revolution, which began in 1910 and is still continuing, may be regarded as a success or a failure. The author points out that one of the chief objects of the Revolution, in its later stages, has been to solve the agrarian problem: to confer responsible proprietorship on a large segment of the population who previously had experienced little more than serfdom. In his concluding chapter he gives, briefly, reasons for believing that the Revolution has been only a qualified success, though the way has been paved for further development, and he suggests tentatively that the personal freedom enjoyed by the general population is probably its greatest achievement.

The book is well printed (though there is a misprint of "father" for "farther" on page 13), and there are some clear photographs at the end. A. V. C-P.

SOUTH AMERICA

A YANQUI IN PATAGONIA. By BAILEY WILLIS. *Stanford University Press* (*London: Geoffrey Cumberledge*), 1947. $9\frac{1}{2}\times7$ *inches;* x+152 *pages; maps and illustrations.* 16*s*

The writer is an American geologist, Emeritus Professor of Geology at Stanford University, California. This book deals mainly with the years 1911–15, when he was employed by the Argentine Government and became acquainted with Dr. Francesco Moreno, the Director of the Museo de la Plata. It was the time of the boundary dispute between Chile and Argentina, which was submitted to the arbitration of King Edward VII (not Edward VI as Professor Willis states). For his services in this matter Dr. Moreno was granted some 30 square miles of lake and mountain on the south-western shore of Lake Nahuel Huapi with which he founded a national park. The area was subsequently extended, very considerably, if Professor Willis' figures are correct, tó 40,000 square miles. Along with autobiographical material, the writer retells the story of the conquest of Chile and of the discovery of the domesticated ground sloth (*Grypotherium domesticus*), which he suggests may have served its master as a cow. The book lightly touches on a variety of topics, most of which are more fully treated in other works. It is illustrated with a few photographs and maps, but has no index. A. H. G. A.

ZWISCHEN ANDEN UND ATLANTIK. By HANS KRIEG. *Munich: Carl Hanser,* 1949. $8\frac{1}{2}\times6\frac{1}{2}$ *inches;* 492 *pages; maps and illustrations*

Professor Hans Krieg is Director of the Zoological Museum in Munich. Starting from Buenos Aires he sailed up the Rio Paraná to the falls of Iguazú and crossed

the Paraguayan Chaco to the foot of Andes at Santa Cruz de la Sierra in Bolivia. Turning eastwards the expedition traversed the northern border of the Chaco to Chiqitos and the Rio Paraguay. Later he was in the Brazilian state of Paraná and finally flew over the Matto Grosso and São Paulo. The manuscript of the book was completed in 1939, but publication was postponed owing to the war. The present volume seems a surprisingly lavish publication for post-war Germany, being profusely illustrated with woodcuts, photographs and coloured plates, which give a very good idea of the animals and the nature of the country. Many of the illustrations are very charming and should be useful for recognition of the animals. It seems a pity that the book was not published in Spanish or English, which would have given it a wider currency in South America.

A. H. G. A.

PACIFIC

THE DISCOVERY OF TAHITI: a journal of the second voyage of H.M.S. *Dolphin* round the world. By GEORGE ROBERTSON. Edited by HUGH CARRINGTON. (Hakluyt Society, Second series, vol. 98.) *London: Hakluyt Society*, 1948. 9×5½ *inches;* lii+292 *pages; maps and illustrations.* 25*s*

This volume should rank as one of the most successful the Hakluyt Society has issued in recent years, because it contains an unusually entertaining narrative, and because the volume has a unity of its own. In Robertson the reader encounters a man of attractive character and of quite unsophisticated intelligence whose warm sympathy for men and nature combined with his unselfconscious gift of expression endow his narrative with enduring vitality. And the narrative is important. The second voyage of the *Dolphin* to the South Seas (1766–1768) cannot be properly appreciated without comparing the official account, based on the journal of her commander, Wallis, and published by Hawkesworth, with that of Robertson, her Master. Hawkesworth's rendering of Wallis is by no means unsatisfactory as a report of the voyage, but the experience of the Captain was one so different from that of the Master that the two accounts enhance each other.

Robertson conveys the feeling of the stormy and protracted passage through the straits of Magellan much more vividly than Wallis, and gives an account of hydrographic survey done in the straits, largely by himself, of which little is said in Wallis's journal. Robertson too was far more interested in the *Dolphin's* consort, the *Swallow*, than Wallis seems to have been, and his evidence has increased the reviewer's admiration for her commander, Carteret, without detracting from the just due of Wallis. Robertson's account of the *Dolphin's* stay at Tahiti, too, will be as important as the very different appearance of things reported by Wallis, in the appreciation of a crisis in native politics to which the *Dolphin* added complications not perceived by her officers and crew. Lastly, his evidence should help in the better understanding of the voyages of his time. Wallis was a sick man during a large part of the second voyage of the *Dolphin*, and his officers were frequently ill when the crew was healthy. From what they suffered is by no means clear, but it was not scurvy. It is interesting to note that Carteret in the *Swallow* also became a very sick man, as did his only remaining officer, between the Santa Cruz and the Solomon islands (Hawkesworth I, pp. 575, 581, 601). Carteret described himself as having "long been ill of an inflammatory and bilious disorder." During the first voyage of the *Dolphin* (1764–1766) Byron reported, when barely three months out and still off the coast of Brazil, that "my three Lieutenants and the Master were at this time so ill as to be incapable of duty, though the rest of the

ship's company were in good health" (Hawkesworth I, p. 12). This all suggests that the conditions under which the officers lived were less healthy than those of the crew, and deserves further study.

The unity of the volume is due to the balance and relevance of the editorial contributions. Carrington's introductory essay is a valuable addition to the historical geography of the Pacific, and leads perfectly up to the narrative which it introduces. The bibliography has to be scanned, if one is to appreciate such things as Robertson's own contribution to British hydrography. The appendices provide just those details of information which the modern reader of eighteenth-century voyages needs. Such fine judgment in bookmaking is rare, and this volume will stand as a monument not only to Robertson, but also to Carrington, its editor, who died before the book was published.

M. A.

PHYSICAL GEOGRAPHY

GEOLOGY: an introduction to earth-history. By H. H. READ. (Home University Library.) *Oxford: University Press*, 1949. $6\frac{1}{2} \times 4\frac{1}{2}$ *inches;* viii +248 *pages; maps, diagrams and illustrations.* 5*s*

Works of genius as a rule make their rare appearances in expensive format, and only years later, when they have become classics, are they made available in cheap pocket editions.

Here in a few small pages will be found a masterly survey of all the essentials of geology. Difficult questions are not avoided; yet there is not an obscure passage from cover to cover. The reader, jaded perhaps from reading some books of similar scope, soon finds a sense of exhilaration creeping over him and his interest quickening, until he can hardly lay the volume down. The absence of circumlocution or jargon, the clearness and directness of the language, and the lightness of touch, produce a stimulating sensation that, for the first time, one is understanding subjects that had previously seemed too deep for the comprehension of ordinary mortals. Even if this is a flattering illusion it is surely good for the morale of the modern student, weighed down as he is by the ever-lengthening tomes that are brought out on ever smaller compartments of the subject of geology.

Interest and surprise are aroused before the narrative is begun, for in the Table of Contents the whole subject is marshalled in five chapters: "The Search for the Method"; "The Sedimentary Rocks as Historical Documents"; "Interventions from the Depths"; "The Revolutionary Episodes"; "The Pattern of Earth History."

Chapter 1 presents a brilliant summary of the history of geology, which contains more of the essentials than are to be found in many larger works and yet reads like a novel. Chapter 2 is an epitome of the principles of geology brought up to date, including such matters as the permanence of the oceans and the time-scale. Chapter 3 is the most interesting and original of all, for here the author expounds his own special subject. He does it in such a way that even the beginner may read it with interest and exhilaration and feel that at last he understands the controversies over granitization, magmas, and migmatites. And although the author has spent a lifetime on the subject-matter of this chapter, he here keeps it in perfect balance with the rest of the book. Chapter 4 is an able epitome of tectonic geology which, in spite of its compression, contains illustrative matter from all over the world as well as an exposition of principles and an unbiassed treatment of great questions such as geosynclines, orogeny, and continental drift. Chapter 5 is mainly a summary of strati-

graphical geology and, perhaps because he is a stratigrapher, the reviewer found this the only dull chapter. Stratigraphy depends on so many details that it is perhaps, like the water that gave it birth, incompressible; it requires a broad canvas and the methods of Eduard Suess. Nevertheless, this chapter contains a mass of valuable matter. On page 178 the student will find all the mysteries of graded bedding and current bedding laid bare at one glance.

If by the time he reaches the last page the reader cannot enter into the spirit of the peroration: "The geologist, standing on the earth as upon a footstool, looks at the past with wonder and turns to the future with hope," it will not be through the fault of the author. W. J. A

RAINFALL AND RUN OFF. By E. E. FOSTER. *New York: Macmillan*, 1948. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* xix+487 *pages; maps and diagrams.* 50*s*

Here is a book by a practical man using precision methods all too little known. Of the two words of the title, rainfall (its causation, measurement, expectation, reliability, distribution, effectiveness, etc.), receive rather more than half the space. Run-off, both above and below ground, takes up most of the remainder. And since the theme is the availability of water, such sources as snow, ice, and dew are not neglected nor are the losses by percolation and evaporation. The author is a practising engineer with twenty-five years' experience of hydrologic studies, accustomed to answer inquiries and to estimate water quantities with the highest degree of precision that can be achieved. The treatment is therefore fully quantitative, well stocked with formulae and graphs by which practical advice can be given on any problem of water supply, flood control, irrigation, drainage, navigation or hydro-electric projects. Though the methods described are of universal applicability, the examples are all chosen from the United States, as are the two hundred items listed in the bibliography. While some may regret this parochialism it has to be admitted with envy that other countries are less fortunate in the availability of basic data, and nowhere else has the matter of water supply received such whole-hearted official support. We read, for example, that the Water Resources Branch of the U.S. Geological Survey has a network of about five thousand river gauging stations and that this is only one of the sources of information on the discharge of rivers. Hydrologists cannot do their work without adequate data. This year's weather has shown, once again, that despite our heavy rainfall we have a water-supply problem too. A survey of our water resources and a national plan for their distribution is long overdue; such books as this emphasize how ill provided we are with the statistical information that is indispensable for devising any such plan.

A. A. M.

HISTORICAL GEOGRAPHY

THE TRADE WINDS: a study of British overseas trade during the French wars 1793–1815. Edited by C. NORTHCOTE PARKINSON. *London: Allen and Unwin*, 1948. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 336 *pages; illustrations and end-paper maps.* 18*s*

This valuable, if uneven, collection of papers is defined in the editor's preface as "an essay in maritime history" designed to open up the "vast and unexplored field of research" awaiting the historian in commercial archives. Maritime history is here to be understood as the study of overseas trade and of its economic and social conditions, to which the diplomatic and naval background is subordinated. The transfer of commodities by sea routes, on which the life of an island society depends, is controlled on the one hand by geographical factors, on the other by the distribution of naval power. The tensions set up by the

interplay of political forces have a spectacular character which tends to obscure the strategical objectives which they serve. As Dr. Parkinson remarks, "the naval historian is too apt to discuss commerce protection without having first discovered what commerce there was to protect. . . . Only by close attention to strategy—and therefore to trade—can naval history maintain touch with the general field of scholarship." That the flag follows trade is a truism familiar to historians of commerce and of colonization, and the scheme of Dr. Parkinson's book plants his subject on a solid geographical and economic foundation. Although his claim that the field is "unexplored" is scarcely supported by the ample bibliography in the volume under review, it is true that the official records which furnish the naval historian with his principal documentary evidence are generally in public repositories and therefore more accessible than the private archives from which maritime history must largely be written.

The book is designed, first, as "ground bait" to attract readers who are not specialists to the study of maritime history; secondly, as a delineation of British sea-borne commerce during the French wars, "a description of conditions, not of events." The choice of period is reasonably defended on the ground that the closing of Europe to British merchants stimulated and expanded the long-distance ocean trades; and the editor draws a telling comparison between the strategical problems of defending these trades against a land-based enemy in the French wars and during the war of 1939–45.

The organization, equipment and technical practices of the ocean trades in general are described in six essays forming Part One of the book. The structure of the shipping industry is the subject of a masterly study of "Shipowning and Marine Insurance," by the late C. E. Fayle. The industry's expanding resources and its growth in flexibility are seen in the differentiation of shipping and trading interests, in the supplanting of the chartered company by the independent merchant, in the rise of coffee-houses as commercial clearing-centres, and in the development of marine insurance. The essays following discuss three representative seaports, the employment of British shipping, ships and seamen of the period, and health and sickness at sea. The authority of the writers is unquestioned; their varying success in presenting large themes in a narrow compass is measured by their choice of a more systematic or a more discursive treatment. They make discreet and often lively use, not only of statistics and official records, but also of less formal material such as seamen's journals and nautical fiction.

Professor J. A. Nixon's study of health and sickness is marred by an ill-founded denigration of the services of Captain Cook in the campaign against scurvy. Resting on Cook's remark (in a letter to Sir John Pringle, 7 July 1776) that "though [the juice of lemons and oranges] may assist other things, I have no great opinion of them alone," this overlooks Cook's mastery of hygienic and preventive measures, enforced by discipline, against the principal causes of scurvy. In the other side of the balance may be set Captain King's observation at the close of the third Pacific voyage under Cook's command: "As to the antiscorbutic remedies, with which we were amply supplied, we had no opportunity of trying their effects, as there did not appear the slightest symptoms of the scurvy, in either ship, during the whole voyage." This result he credits to "an unremitting attention to the regulations established by Captain Cook." Significant sample figures quoted by Professor Nixon indicate that, while in 1757 some 19 per cent. of sickness afloat may have been due to scurvy, by 1782 the proportion had fallen to 6 per cent. Between these dates lay Cook's career.

Part Two provides studies of six principal ocean trades—the East Indian, the

West Indian, the American, the Newfoundland, the Slave Trade, and the Post Office Packets. These papers, thoroughly documented but easily written, present in a convenient form material of geographical interest, on the source and composition of cargoes, the channels of trade, sailing passages and routes, and much else. A misprint may be noted on page 273, where Dr. Andreas Sparrman's name twice appears as " Spaarman." A concise glossary of nautical terms and a classified bibliography follow.

The book may be read with pleasure by the uninformed, with profit by the informed reader, and is a conspicuous addition to Dr. Northcote Parkinson's many services to nautical history. The illustrations are appropriate and well reproduced, but the unhappy practice of printing maps on the end-papers must once more be regretfully recorded. R. A. S.

GENERAL

FUNDAMENTALS IN SCHOOL GEOGRAPHY. By OLIVE GARNETT. *London: George G. Harrap, 1949. 7½×5 inches; 332 pages; sketch-maps, diagrams and illustrations. 10s 6d*

This is a new and revised edition of a well-known book, first published in 1934, by an authority on the teaching of geography to young children. Since that year school organization has been considerably affected by the Act of 1944 and there have been marked developments in teaching practice, especially in the direction of field work and in the use of "activity" methods generally. It is a pity that the book could not have been entirely rewritten, but it must be stated that Miss Garnett has made as good a job as possible in blending the new with the old. Nevertheless, if she had been able to give a more extended treatment of the modern craze for dropping such subjects as history and geography from the timetable and merging them into "environmental studies" or "social studies," she would have provided even more help and guidance for those for whom the book is primarily intended: students in training colleges preparing to teach children up to the age of eleven or twelve.

This is a very good book which all teachers of geography in primary schools should read; secondary school teachers too will find in it many ideas and suggestions applicable to the teaching of older pupils. L. B.

ADDITIONS TO THE LIBRARY AND MAP ROOM

EUROPE

DER WINTER IN NORDEUROPA; eine wirtschafts-klimatologische studie.
By J. Blüthgen. (*Petermanns Mitt.* 92 (1948) 113–33 maps and illustrations)

THE GEOLOGY OF THE EASTERN PART OF THE ENGLISH CHANNEL
By W. B. R. King. (*Q.J. Geol. Soc.* 104 (1949) 327–38 map)

NORTH EAST COAST: a survey of industrial facilities
By the Research Staff of the Northern Industrial Group. 11½×9. xvi+146 pp. Maps and illustrations. *Newcastle-upon-Tyne: Andrew Reid*, 1949. 45*s*

The area studied comprises Northumberland, Durham and the North Riding, for which are given factual statements of the natural resources, communications and ports, public services, and available labour, with a number of clear folding maps.

THE WATER MILLS OF THE RIVER GRANTA
By D. R. C. West. (*Compass* (*Cambridge*) 1 (1949) 77–92: illustrations)

THE PEGSDON DRY VALLEYS
By W. V. Lewis. (*Compass* (*Cambridge*) 1 (1949) 53–70: illustrations)

THE HISTORY OF THE RIVER DART, DEVON
By J. F. N. Green. (*Proc. Geol. Assocn.* 60 (1949) 105–24: maps)

THE HIGHLANDS AND ISLES: their regional planning
By A. Geddes and F. D. N. Spaven. 9½×6; 54 pp. Maps and illustrations. *Edinburgh: Outlook Tower*, 1949. 5*s*

THE TOWN AND DISTRICT OF CARRICK-ON-SHANNON, CO. LEITRIM
By T. W. Freeman. (*Irish Geogr.* 2 (1949) 1–19: illustrations)

JORDBRUKETS GEOGRAFI I NORGE: ATLAS
By A. Somme. (*Skrifter Norges Handelshøyskole* 3B (1949) 100 pp. of maps and tables)

STOCKHOLMS SKÄRGÅRD; kulturgeografiska undersökningar i Värmdö gamla skeppslag
By B. Hedenstierna. (*Geogr. Ann.* 30 (1948) 1–444: maps and illustrations)

A study of the human geography of the "Skärgård" from 1600.

UNTERSUCHUNGEN ÜBER DEN MIKKALI-OS
By V. Okko. (*Fennia* 69 (1945–46) no. 1, 55 pp.: illustrations)

A glacial land-form associated with the Salpausselkä.

ON VARIATIONS IN CLIMATE, IN CROP OF CEREALS AND IN GROWTH OF PINE IN NORTHERN FINLAND, 1890–1939
By I. Hustich. (*Fennia* 70 (1947–48) no. 2, 24 pp.)

KULTUR- UND NATURLANDSCHAFT IM KEUPERBERGLAND ZWISCHEN MAIN UND AISCH
By G. Kreuzer. (*Petermanns Mitt.* 92 (1948) 57–69: map)

The map, on the scale of 1:50,000, shows the composition by species of afforested areas.

MAXIMA ET MINIMA PLUVIOMÉTRIQUES EN FRANCE
By E. Berthaud. (*Études Rhodaniennes* 24 (1949) 7–36)

BÉZIERS, ÉTUDE DE GÉOGRAPHIE URBAINE
By G. Galtier. (*Bull. Soc. Languedoc. de G.* 19 (1948) 3–125: maps and illustrations

DEUX PLAINES DU BAS-DAUPHINÉ: la Bièvre et le Liers
By G. Espinasse. (*Rev. de Géogr. Alpine* 37 (1949) 3–68: illustrations)

TRAVELLERS IN SWITZERLAND
By G. R. de Beer. 8½×5½. xviii+584 pp. Illustrations. *London: G. Cumberlege* (*O.U.P.*), 1949. 25*s*

The main portion of this work is a chronological list of travellers in Switzerland during the past thousand years, indicating their itineraries, and usually with extracts from their narratives. It is completed by a topographical index and an index of travellers.

RAPPORT SUR LA MODERNISATION DE LA VIE MONTAGNARDE EN SUISSE
By P. Veyret. (*Rev. de Géogr. Alpine* 37 (1949) 379–420)

DIE LANDSCHAFTEN OBERÖSTERREICHS IM SPIEGEL DES BAUERNHAUSES
By R. Heckl. (*Mitt. Geogr. Ges. Wien* 91 (1949) 21–45: diagrams)

DIE GÜSSINGER LANDSCHAFT; ein übervölkertes österreiches Grenzland

By L. Graupner. (*Geogr. Jhrb. aus Österreich* 23 (1949) 1–124

A transitional area between the Alpine foothills and the central Danube plain. Overpopulation is due to the pressure of an almost entirely agricultural population on a limited area of poor soils.

LA GLACIAZIONE QUATERNARIA DELL'APPENNINO SETTENTRIONALE

By U. Losacco. (*Riv. G. Ital.* 56 (1949) 91–152)

SLOVENE CARINTHIA

By A. Melik. (*Geogr. Vestnik, Ljubljana* 20–21 (1948–49) 3–36). In Croat: English summary.

GÉOGRAPHIE ÉCONOMIQUE DE LA "GORA" DE LA MONTAGNE DU CHAR

By M. Lutovac. (*Bull. Soc. Serbe de Géogr.* 28 (1948) 97–111). In Serbian: French summary.

EL MEDIO Y LA VIDA EN ANDORRA

By S. Llobet. (*Consejo Superior de Investig. Cientificas*) $9^1/_2 \times 6^1/_2$. 348 pp. Map and illustrations. *Barcelona*, 1947

UNE CARTE TOPOGRAPHIQUE DU PORTUGAL AU 16e SIÈCLE

By G. de Reparaz. (Extr. fr. *Mélanges . . . G. le Gentil*) $11 \times 7^1/_2$: 271–315 pp. *Lisbon: Instituto para a Alta Cultura*, 1949

The survey, which is preserved in the Escurial, was carried out between 1550 and 1560. The author believes it to be the first attempt at the survey of a European country.

ASIA

IST IN OSTASIEN DER SOMMERMONSUN DER HAUPTNIEDERSCHLAGSBRINGER?

By H. Lautensach. (*Erdkunde* 3 (1949) 1–18: diagrams)

The author concludes that the summer monsoon is not the main source of rain.

PROBLEMS OF ECONOMIC DEVELOPMENT IN AFGHANISTAN

By P. G. Franck. (*Middle East J.* 3 (1949) 293–314)

BASIC PRINCIPLES OF THE DISTRIBUTION OF THE VEGETATION OF AFGHANISTAN

By I. A. Linchevsky and A. V. Prozorovsky. (*Kew Bull.* no. 2 (1949) 179–214: map)

LA CHINE: passé et present

By Jean Escarra. $6^1/_2 \times 4^1/_2$. 224 pp. *Paris: Armand Colin*, 1949. *Fr.* 180

The second edition of a short work by a sinologist and expert in Chinese law, which includes a historical sketch and an analysis of Chinese civilization.

UN "MORVAN" EN CHINE: Nan Yo, la montagne sacrée du Sud; étude morphologique

By Wu Shang Shih. (*Études Rhodan.*, 24 (1949) 109–116; diagrams)

THE DISTRIBUTION OF RELIGIOUS COMMUNITIES IN INDIA

By J. E. Brush. (*Ann. Assocn. Amer. Geogr.* 39 (1949) 81–98: maps)

STURM AUF DIE THRONE DER GÖTTER

By Rudolf Skuhra. $9^1/_2 \times 6$. 198 pp. Illustrations. *Wien: Volksbuchverlag*, 1949

Accounts of the expeditions which have attempted to climb the 8000-m. peaks of the Himalaya, 1921–48, with 24 photographs.

GEOGRAPHICAL STUDY OF THE NITRE CAVE DISTRICT [CEYLON]

By N. Leiter. (*Bull. Ceylon Geogr. Soc.* 3 (1948–49) 61–72: diagrams)

OUTLINE OF THE GEOMORPHOLOGY OF JAVA

By A. J. Pannekoek. (*Tijds. K. Nederl. Aardr. Gen.* 66 (1949) 270–326: map and diagrams)

Accompanied by a physiographic map of Java on the scale 1/1·25 M.

NEUE BEITRÄGE ZUR GEOMORPHOLOGIE VON TUWA

By W. Leimbach. (*Petermanns Mitt.* 93 (1949) 66–75)

AFRICA

COMPTES RENDUS DE LA CONFÉRENCE AFRICAINE DES SOLS, NOV. 1948. Vol. 1. (*Bull. agric. du Congo Belge*, 40, no. 1 (1949) 1048 pp.)

This volume contains the papers read in the first section—"Étude générale et regionale des sols."

MATÉRIAUX POUR L'ÉTUDE DU SAHARA ORIENTAL: géologie et préhistoire

By M. Dalloni. (*Mission sc. du Fezzân* 1944–45, vol. 6, i). RECONNAISSANCE AU DOHONE

By T. Monod. (*Id.*, vol. 6, ii). *Alger: Inst. de Recherches Sahariennes*, 1948

THE FUR
By A. C. Beaton. (*Sudan Notes & Records* 29 (1948) 1–39: illustrations).
Describes the customs of the people of Western Darfur.

LITTLE-KNOWN TRIBES OF THE BAHR EL GHAZAL
By S. Sant'andrea. (*Sudan Notes & Records* 29 (1948) 78–106)

LES GRANDS TRAITS DE LA GÉOGRAPHIE PHYSIQUE . . . DANS LE NORD-EST DE LA LUNDA (ANGOLA)
By E. Polinard. (*Bull. Soc. belge de géol.* 57 (1948) 541–54)

THE BELGIAN CONGO: IMPRESSIONS OF A CHANGING REGION
By R. L. Pendleton. (*Geogr. Rev.* 39 (1949) 371–400: illustrations)

STUDIES IN AFRICAN LAND-USAGE IN NORTHERN RHODESIA
By W. Allan. (*Rhodes–Livingstone Papers* 15 (1949) 86 pp.: sketch-maps)

THE ASIATIC IMMIGRANT COMMUNITY IN THE UNION OF SOUTH AFRICA
By K. Buchanan and N. Hurwitz (*Geogr. Rev.* 39 (1949) 440–49)

DURBAN: ITS SPHERE OF INFLUENCE AS A REGIONAL CAPITAL
By T. J. D. Fair. (*S. African G.J.* 31 (1949) 77–92: sketch-maps)

ELGIN, CALEDON DISTRICT, CAPE PROVINCE; a land utilization survey
By M. M. Cole. (*S. African G.J.* 31 (1949) 36–76: maps and illustrations)

NORTH AND SOUTH AMERICA

PERMAFROST IN CANADA
By J. L. Jenness. (*Arctic* 2 (1949) 13–27: map and diagrams)
The map shows the distribution of permafrost and its approximate southern limit.

HYDROLOGIE DU SAINT-LAURENT ET DE SES AFFLUENTS
By M. Pardé. (*Rev. canadienne de G.* 2 (1948) 35–83: map and diagrams)

WEALTH FROM THE CANADIAN SHIELD
By B. J. McGuire and H. E. Freeman. (*Canadian G.J.* 38 (1949) 198–227: illustrations)

INTROD. TO THE GEOGRAPHY OF NEWFOUNDLAND
By B. V. Gutsell. (*Informatn. ser., Geogr. Bureau, Canada*, 1 (1949) 86 pp.: illustrations)

OBSERVATIONS IN KAMISHAK, ALASKA
By W. F. Thompson. (*Geogr. Rev.* 39 (1949) 450–71: illustrations)
Discusses the possibilities of settlement, the greatest obstacle to which is the isolation of the area.

LAND ASSOCIATIONS AND OCCUPANCE PROBLEMS IN THE UINTA COUNTRY
By W. C. Calef. 9×6. vi+174 pp. *Chicago: Dept. of Geography, University*, 1948

THE NATURAL VEGETATION OF THE WINDWARD AND LEEWARD ISLANDS
By J. S. Beard. (*Oxford Forestry Mem.* 21 (1948) 192 pp.: illustrations and diagrams) 25*s*

ESTUDIO DE LA REGION DE MAYARI
By A. Nuñez Jimanez. (*Rev. Soc. G. Cuba* 21 (1948) 37–69)
A little-known area of eastern Cuba

L'AMAZONIE: problèmes géographiques
By P. Gourou. (*Cahiers d'outre mer* 2 (1949) 1–13: illustrations)

A VEGETAÇÃO E O USO DA TERRA NO PLANALTO CENTRAL
By L. Waibel. (*Rev. Brasil. de G.* 10 (1948) 335–80: illustrations)

AUSTRALASIA AND PACIFIC

A REVIEW OF TECTONIC RELIEF IN AUSTRALIA
By C. A. Cotton. (*J. of Geol.* 57 (1949) 280–96)

THE CATTLE INDUSTRY IN NORTHERN AUSTRALIA
By J. W. Fletcher. (*Walkabout*, 15 (*April* 1949, 10–18: illustrations)

THE KIMBERLEYS: a national responsibility
By J. K. Ewers. (*Walkabout*, 15 *July* 1949, 10–17: illustrations)

A SOIL SURVEY OF THE HUNDRED OF SEDDON and part of the Hundred of Macgillivray, Kangaroo Island, South Australia
By K. H. Northcote and B. M. Tucker (*Council Sc. & Industr. Research, Bull.* 233 (1948) 92 pp.: maps and plates)

HANDBOOK FOR TASMANIA
Ed. by L. Cerutty. (*Austr. and N.Z. Assocn. Adv. Sc.*) $9\frac{1}{2}\times7$. 128 pp. Maps. *Hobart*, 1949. 10*s*

LES NOUVELLES HÉBRIDES: ILES DE CENDRE ET DE CORAIL
By E. Aubert de la Rüe. 8×5. 254 pp. Maps and illustrations. *Montréal: l'Arbre*, 1945. 8*s* 6*d*
An account of the islands and their peoples by a geologist who travelled extensively through them in 1934–36.

A REVIEW OF CONCEPTS IN HAWAIIAN CLIMATOLOGY
By L. B. Leopold and C. K. Stidd. (*Pacific Sc.* 3 (1949) 215–25)

POLAR REGIONS

TEKTONIK UND VULKANISMUS IN DER ANTARKTIS UND DEN BENACHBARTEN MEERESTEILEN
By E. Herrmann. (*Petermanns Mitt.* 92 (1948) 1–11: map)

GEOGRAPHICAL TESTS OF THE HYPOTHESIS OF CONTINENTAL DRIFT IN THE ARCTIC REGIONS
By C. E. Wegman. (*Medd. om Grønland* 144 (1948) no. 7, 48 pp.: maps)

A YEAR ON THE ANTARCTIC CONTINENT
By W. R. Latady. (*Appalachia* no. 107 (June 1949) 273–81: illustrations)
By a member of the Ronne expedition.

GENERAL

SHORE PLATFORMS
By E. S. Hills. (*Geol. Mag.* 86 (1949) 137–52: illustrations)
Discusses processes of formation from examples in Victoria.

SCHMELZUNG UND VERDUNSTUNG VON EIS UND SCHNEE IN IHREM VERHÄLTNIS ZUR GEOGRAPHISCHEN VERBREITUNG DER ABLATIONSFORMEN
By C. Troll. (*Erdkunde* 3 (1949) 18–29: illustrations)

EAST–WEST BALANCE OF THE QUATERNARY ICE CAPS IN PATAGONIA AND SCANDINAVIA
By E. Ljungner. (*Bull. Geol. Inst. Upsala* 33 (1949) 11–96: maps)

DIE ENTWICKLUNG DER GROSS-STÄDTE IN HAUPTLÄNDERN DER INDUSTRIE
By L. Mecking. (*Planung, Hamburg*, no. 2 (1949) 102 pp.: maps)
A comparative study of the growth of the great centres of population in Britain, Germany, U.S.A., and Japan in relation to industrial development, with discussion of plans for the future. The maps show population increases from 1865.

BODEN UND BÄUERLICHES SOZIALGEFÜGE
By R. Klöpper. (*Petermanns Mitt.* 93 (1949) 49–66)
An examination of the relation between soil types and the size of holdings and social structure in agricultural communities.

THE WORLD'S WEALTH
By R. W. Brooker. (*The Charter Geographies.*) $8 \times 5\frac{1}{2}$. 236 pp. *London: G. C. Harrap*, 1949. 6*s*
An introduction to the study of the world's resources. Attention is given to recent economic developments and their effect on Britain.

SHADOWS IN THE SUN
By Stephen Taylor and Phyllis Gadsden. $8\frac{1}{4} \times 5\frac{1}{2}$. 188 pp. Illustrations. *London: G. C. Harrap*, 1949. 15*s*
An account of the work of the Colonial Health Services in combating tropical diseases.

CARTOGRAPHIE GENEVOISE DU XVI^e^ AU XIX^e^ SIÈCLE
By M. A. Borgeaud (*Archives internat. d'hist. des sc.* no. 6 (1949) 361–75)

ATLASES AND MAPS

WORLD

ATLAS MONDIAL par Jean Dollfus. 12×8 ins. 86 plates of maps; 104 pp. text; 88 pp. index. *Paris: Girard, Barrère, et Thomas*, 1948. 42*s*

SCHWEIZERISCHER MITTELSCHULATLAS herausgegeben von der Konferenz der Kantonalen Erziehungsdirektoren . . . durch Ed. Imhof. Neunte Auflage. $14 \times 9\frac{1}{2}$ ins. 144 plates of maps. *Zürich: Art. Institut Orell Füssli A.G.*, 1948. 21 *Swiss francs*
The jubilee edition of a well-designed school atlas. In addition to layer coloured physical maps, there are insets on larger scales illustrating particular land forms, and typical settlement types, as well as geological, climatic and economic maps. Names on the maps have been kept to a minimum.

WORLD AERONAUTICAL CHARTS, 1/1M. 43 sheets. *Washington: U.S. Coast and Geodetic Survey*, 1949, *price* 25 *cents each sheet*

AERONAUTICAL PLANNING CHARTS, 1/5M. 43 sheets. *Washington: U.S. Army Air Forces*, 1948–1949

ADMIRALTY CHARTS, 6 New Charts, 4 New Editions, 24 Large Corrections, 3 "Decca" Lattice Charts. *London: Hydrographic Dept.*, 1949

AIR COMMUNICATIONS of Britain and the Commonwealth. Compiled by Pictorial Charts Unit in collaboration with British Overseas Airways Corporation. *London: Univ. of London Press*, 1949, *price* 5*s* 6*d*

REGIONS OF THE WORLD CHARTS. No. 1. Equatorial Forest Regions. Prepared and published by the Pictorial Charts Unit in consultation with G. J. Cons. *London: Univ. of London Press*, 1949. *Price 6s 6d*

WALL CHARTS: Europe, Norway, Switzerland, Far East, Ceylon, India and Pakistan, East Bengal. *London: Educational Productions Ltd.*, 1948

EUROPE

EUROPE. Agricultural Geography of Europe and the Near East. 11 × 14 ins. 68 pp. of maps and text. *Washington: U.S. Dept. of Agriculture*, 1948

AUSTRIA. KARTE DER STUBAIER ALPEN. 1 : 25,000. Südbatt. *Innsbruck: Alpenverein*, 1949

GREAT BRITAIN. ORDNANCE SURVEY. Six-inch map, provisional edition, on National Sheet Lines, 4 sheets, *price 4s per sheet;* 106 Quarter sheets, *price 2s per sheet;* 1 : 25,000. 116 sheets, *price 2s per sheet. Chessington*, 1948–49

ENGLAND AND WALES. GEOLOGICAL SURVEY. 1 : 63,360. Sheets, Drift: 17, 18, 138, 153, 342, 359; Solid: 18, 85; Solid with Drift: 167. *London*, 1949. *Price 5s per sheet*

SWEDEN. Konceptblad 1 : 50,000. 4 sheets; Karta över Sverige 1 : 100,000. 10 sheets; Översiktskarta 1 : 400,000. 1 sheet; Leatz Skogskarta 1 : 400,000. 25 sheets. *Stockholm: Generalstabens Litografiska Anstalt*, 1937–1948

SWEDEN. SVERIGES GEOLOGISKA UNDERSÖKNING 1 : 50,000. 2 sheets; Jordartskarta över Södra och Mellersta Sverige av K. E. Sahlström 1 : 400,000. 3 sheets. *Stockholm*, 1947–1949

AFRICA

AFRICA. GENERAL MAP OF AFRICA 1/10M. *Edinburgh: John Bartholomew & Son*, 1949, *price 4s, paper*

A new layer coloured map.

ANGLO-EGYPTIAN SUDAN 1 : 250,000. Sheets: 46E, 55D, F, H. *Khartoum: Survey Dept.*, 1949

GAMBIA 1 : 50,000. Sheets, 9, 19, 20. *Teddington: Directorate of Colonial Surveys*, 1949. *Price 3s 6d per sheet*

UGANDA, MAP OF UGANDA PROTECTORATE, 1/1M. *Entebbe: Survey, Lands and Mines Dept.*, 1948

UNION OF SOUTH AFRICA. GEOLOGICAL SURVEY 1 : 50,000. Pietermaritzburg and Environs. *Pretoria*, 1948

NORTH AMERICA

UNITED STATES. GEOLOGICAL SURVEY. Quadrangle Topographic Sheets: 1 : 24,000. 129 sheets; 1 : 31,680. 12 sheets; 1 : 62,500. 28 sheets. *Washington:* 1949

UNITED STATES. SECTIONAL AERONAUTICAL CHARTS 1 : 500,000. 87 sheets. *Washington: U.S. Coast and Geodetic Survey*, 1948–1949, *price 25 cents per sheet*

MEXICO. ESTADOS UNIDOS MEXICANOS 1 : 500,000. 51 sheets. *Tacubaya: Secretaria de Agricultura y Fomento*, 1943–1949

AUSTRALIA AND NEW ZEALAND

AUSTRALIA. T.A.A. Map of the Commonwealth of Australia showing Air Routes, Industries and Routes of Explorers, 1 : 5,400,000. *Melbourne: Trans-Australia Airlines*, 1949, *price 3s*

NEW ZEALAND 1 : 25,000. 35 sheets. *Wellington: Dept. of Lands and Survey*, 1941–1948

THE SOCIETY'S NEWS

ACADEMIC APPOINTMENTS AND DISTINCTIONS

Several appointments to University Chairs of Geography have been made during the year: Mr. J. A. Steers to the chair at Cambridge in succession to Professor Frank Debenham; Professor L. Dudley Stamp to the new Chair of Social Geography, tenable at the London School of Economics and Political Science; and Dr. R. O. Buchanan to the chair at that School vacated by Professor Stamp. Professor H. C. Darby, Liverpool University, has accepted an invitation to the Chair of Geography at University College London, in succession to Professor C. B. Fawcett who retired in September.

The University of Aberdeen has conferred the honorary degree of Doctor of Laws upon Professor E. G. R. Taylor, Professor Emeritus of Geography in the University of London. Mr. W. Vaughan Lewis, lecturer at Cambridge, has been elected into a fellowship at Trinity College, Cambridge.

THE QUEEN MAUD LAND EXPEDITION

October and November saw the final preparations for the sailing of the Norwegian-British-Swedish Expedition to the Antarctic whose British headquarters are still at the Society's House. On October 26, the whaling factory ship *Thorshövdi* left Sandjefiord, Norway, carrying sixty dogs, the three amphibious "weasels," and much other heavy gear as well as five members of the Expedition, including Alan Reece, the second British geologist, and Charles Swithinbank, geographer and glaciologist. The 700-ton expedition ship, the Norwegian sealer *Norsel*, completed in record time at Flensburg, arrived at Göteborg on November 1 to pick up the Swedish party with their equipment and returned to Oslo. On November 17 she left Oslo and sailed for London where she arrived at the Shadwell Basin, London Docks, on Sunday November 20. On Sunday afternoon, she was invaded by a small army of pressmen, radio reporters and cameramen. Loading started the following day and despite the problem presented by the two aircraft and 1900 cubic feet of other equipment, she sailed on time at half-past two o'clock on Wednesday November 23. Throughout this period, the Expedition received the greatest possible cooperation from the officials of the Port of London Authority and other organizations involved, the Authority being generous enough to waive all dock dues in view of the scientific nature of the Expedition. Further reports on the Expedition's progress will appear from time to time in the *Journal*.

Before sailing final plans, and especially the programmes for scientific work, were examined at a series of meetings held at the Society's House in October under the chairmanship of Mr. J. M. Wordie. Both Professor Ahlmann and Professor Sverdrup were present. It was felt that the programme, though necessary in an international expedition covering so many fields of science, should not in any way fetter the decisions of the leader, since the conditions which the expedition will find in Queen Maud Land are as yet little known.

The geologists should have exceptional opportunities for attacking the general problems of Antarctic geology, for the air photographs taken on the German *Schwabenland* expedition of 1939 reveal a considerable extent of ice-free land. They suggest the presence of a complex of unstratified rocks to the east and relatively undeformed sediments to the west. The latter may be related to the Beacon Sandstone series of the Queen Maud Range at the head of the Ross

Barrier and the unstratified complex may be a "shield" area; the core of the continent. The summer journeys of the geologists will be directed to these problems.

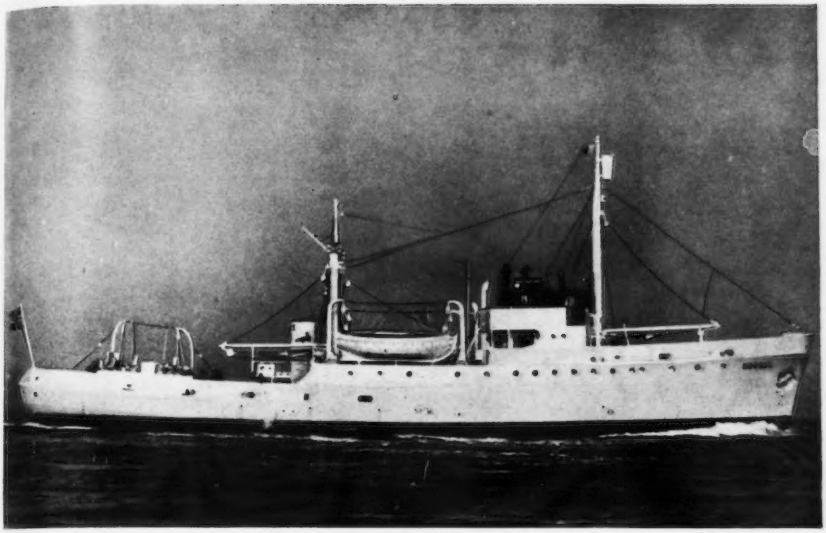
Precise astronomical observations will be made at the base. The survey on summer journeys, supplemented by air photography, will greatly extend our knowledge of the topography of Queen Maud Land and its mountains, hitherto seen only from the air.

The glaciological programme is comprehensive. If the base camp can be sited where the inland ice rests on rock, a deep bore hole will furnish a section of glacier-ice and the core will provide material for a crystallographic analysis. A continuous record of temperature at various depths in the bore hole will be maintained during the stay of the expedition. The movement of the ice will be studied by repeated measurements of the positions of marker stakes and the precise astronomical observations may reveal a change in the position of the base itself. The depth of the ice-cap will be measured by seismic sounding and the profile of the underlying rock-surface will be obtained along a line from the island plateau to the sea, by repeated seismic soundings on summer journeys. Attention will be paid to moraines and other marginal phenomena in the ice-free mountains of the interior and there should be a valuable comparison between the photographs now to be taken and those obtained from the air in 1939. The glaciological regime at the base station will be studied in collaboration with the meteorologists, and micro-photographs will be made of solid precipitation, hoar-frost and drifting snow.

Standard meteorological records will be maintained at the base and upper-air observations will be made with *radio sonde* balloons and with *Rawin* (a radio equipment for following the track of balloons in all weathers). Surface radiation will be specially studied and detailed observations made on temperature changes in the lower layers of the atmosphere, and on the drifting of snow. Aurora will be observed by photography. The daily weather observations at the base will be broadcast by wireless, in collaboration with the other stations operating in the Antarctic; the Falkland Islands Dependencies Survey, the French expedition in Adélie Land and the Australian stations on Heard Island and Macquarie Island.

AIR MINISTRY PHOTOGRAPHS

In a review of 'Geography and air photographs' published in April last (*Geogr. J.* 112 (1948) 242) it was stated that prints from the Air Ministry collection were available at 10*d* each. We are asked by the Ministry to say that this is not strictly correct. The charge to the public is 1*s* 8*d* per print, but to bona fide students and research workers it is 9*d*. To obtain them at the reduced rate Fellows should apply through the Society.



Phot. The Times

m.v. Norsel

Phot. The Times

Some members of the expedition

(Left to Right). V. Schytt; Fl. Lt. H. Tudor, D.F.C.*; Sq. Ldr. G. B. Walford; Capt. J. Giaever (leader); N. Roer; G. de Q. Robin; N. J. Schumacher; T. Stobart*

THE ANTARCTIC

Oblique zenithal equal-area projection

THE RECORD

THE MEETING OF THE BRITISH ASSOCIATION, 1949

The British Association for the Advancement of Science met at Newcastle-upon-Tyne from August 31 to September 9, under the Presidency of Sir John Russell, O.B.E., F.R.S. The Presidential address on world population and world food supplies contained much of direct interest to geographers.

The meetings of Section E were well attended throughout a busy week. On the first day Mr. A. E. Smailes and Mr. J. W. House considered broad aspects of the population of north-east England, and Mr. M. R. G. Conzen gave an account of the urban geography of Newcastle. A paper by Mr. R. M. Prothero discussed settlement patterns in the Llyn Peninsula, and two dealt with the Pennines: Dr. Garnett gave an account of her climatological investigations in the High Peak area and Mr. Savigear considered slope forms and slope formation in the Southern Pennines.

The programme on Friday began with the Presidential address by Professor L. Dudley Stamp, C.B.E., on the planning of land use, a subject appropriate to the first holder of a chair of Social Geography in this country. His conclusion was that "there is room in Great Britain both for the proper rehousing of our people and the maintenance of home food production—or at least the conservation of the land for that purpose." Mr. T. W. Freeman followed with a paper on rural Ireland in 1841 and the morning ended with Miss Day's exposition of the relative permanence of political frontiers in India. The afternoon was taken up by a discussion on Field Study and research centres. Valuable descriptions of the centres at Flatford Mill, Dale Fort, Juniper Hall, and Malham Tarn were given.

On Saturday, the main interest of the excursion in County Durham was the new towns of Aycliffe and Peterlee. Here the discriminating comments of Mr. James were of great interest. On Sunday members had the opportunity of seeing a very different landscape in Northumberland, or of spending a profitable afternoon in Durham.

On Monday morning papers were related to the general topic of the President's address. Professor Miller dealt with the climatic requirements of the major formations of natural vegetations. Mr. N. R. Wills and Mr. J. M. Houston spoke of the importance of irrigation, the former in Australia and the latter in Spain. Mr. Bowen Jones gave a valuable paper on the distinction between peasantry and small farming. In the afternoon Mr. Mather dealt with migration in the Anglo-Egyptian Sudan and Dr. L. F. Richardson made a unique contribution to the mapping of population by "cells."

Tuesday morning was taken up by papers on regional geography. Professor Darby's contribution was on the sources for the regional geography of England in the nineteenth century. Mr. R. T. Cornish followed with a paper on east central Sweden. Mr. S. J. Jones dealt with the relationship between historical geography and regionalism as illustrated in California and Mr. J. P. Houghton showed the value of local newspapers as a guide to the functions of Irish towns. On Tuesday afternoon the more fortunate members of the Section enjoyed a trip on the river Tyne. The Sectional dinner in the evening drew record numbers including our foreign guests, Professors Boerman of Rotterdam and Axel Sömme of Bergen. Its unqualified success was due to the work of the local Secretary, Mr. Conzen, and to the efficiency and understanding of the management of the "Turk's Head."

This year, to meet the wishes of the Council of the Association, papers were

read on Wednesday morning. The readers of the papers may have felt that smaller audiences, of about sixty, hardly justified the experiment. Special thanks are therefore due to Dr. W. B. Fisher and to Mr. H. R. Wilkinson for their respective contributions on the climate of the eastern Mediterranean and monsoon circulation, and ethnographic maps of Macedonia.

A particular word of congratulation must go to Professor Stamp. Rarely has a President attended so many papers. In a room inadequately ventilated, and usually overcrowded, he occupied the Presidential chair at most of the meetings and not only stimulated discussion by his pertinent remarks but had a word of encouragement or praise for all the readers of papers. The standard he set will be an inspiration to his successors. To Professor Daysh, Mr. Slater and Mr. Conzen, the meeting owed much, and the excursions gave them an opportunity which they took fully.

Mr. Baker's term of office as Recorder has expired. He is succeeded by Professor D. L. Linton, The University, Sheffield, 10, to whom offers of papers to be read at the meeting at Birmingham should be sent immediately.

J. N. L. B.

THE THIRD INTERNATIONAL CONGRESS ON NAME STUDIES

The Troisième Congrès International de Toponymie et d'Anthroponymie opened at Brussels with a reception of the foreign delegates at the Institut Géographique Militaire on 14 July 1949, and closed with a banquet at the Palais des Beaux Arts on the night of July 19. It was an enjoyable and successful reunion, mainly of toponymists and philologists, of whom about three hundred attended, representing thirty-two countries. Papers were read and discussions held in the lecture rooms of the Université de Bruxelles. A wide range of studies was covered, but the interest in such subjects as *noms de lieux-dits* (the names of fields and parcels of land without habitation) was marked. Papers on the cadastral surveys of France and Belgium stressed the importance of a revision of these names, and of their collection into alphabetical lists. At an exhibition of publications on dialect and toponymics held at the Instituut voor Naamkunde at Louvain, the most noteworthy exhibits were from Scandinavia. The extent of the Swedish contribution to the study of English place-names was as remarkable as it was unexpected.

The congress has recommended to UNESCO that a permanent international committee for onomastics be set up, and that a permanent centre for the subject be established at Louvain. It was decided that the fourth congress be held in 1952, but the question of the place of meeting was deferred; four countries have extended equally acceptable invitations and it is hoped that the proposed permanent international committee shall be the authority with which the choice will lie.

M. A.

A JUGOSLAV GEOGRAPHICAL CONGRESS

The first Congress of Jugoslav geographers to be held since the establishment of the Federated People's Republic of Jugoslavia took place from October 3 to 8, in the territory formerly held by Italy. Over two hundred geographers from all parts of Jugoslavia attended the Congress. They included the staffs of the four Departments of Geography in the Universities of Beograd, Zagreb, Ljubljana and Skopje,[1] geographers attached to various Departments of State and Ministries, and representatives from Technical Institutes and High Schools.

The Congress opened in Rijeka under the presidency of Dr. J. Roglić, Professor of Geography in the University of Zagreb. He pointed out in his preliminary remarks that the *venue* of the Congress was chosen in order to give

[1] The spellings are those supplied by the writer.—Ed. *G.J.*

Jugoslav geographers the opportunity of viewing the new territory and of seeing for themselves how it was faring under Jugoslav rule. After the Minister of Education had given his blessing to the meeting, the Mayor of Rijeka—a woman communist who had spent the greater part of the war in concentration camps—extended a hearty welcome to the delegates and to the foreign guests, Dr. A. E. Moodie of London and Mr. H. R. Wilkinson of Liverpool. A telegram was despatched to Marshal Tito and then the delegates got down to the work of the conference.

A very full programme of papers, discussions and excursions had been arranged by the organizing committee. There were also official receptions given to the delegates by local organizations. On the first day papers were read by the President, Professor Roglić, on "The Port of Rijeka and the general importance of the liberated territory," and by Dr. Sv. Ilešič on "Problems of the new Italo–Jugoslav frontier." In the afternoon the delegates examined the site of the port under the guidance of Dr. Ivo Rubić and embarked in launches to inspect the harbour and its shipping.

The next day was spent in touring the Istrian coast and the delegates were fortunate to have leaders of the calibre of Professor J. Roglić and Professor A. Melik, Chancellor of the University of Ljubljana, to point out such interesting features as coastal formations in karst, acropolis-type settlements and their significance and function, and finally the karst coalfield of Raša. The welcome of the miners of Raša to the Congress included a lunch which began at five minutes to one and lasted approximately until half-past four. As an aid to digestion the delegates then took a ride on a coal-tram to see, in the words of our guide, the "Cardiff of Jugoslavia"—the small port that serves the coalfield. On the following day proceedings opened with a paper by Dr. Rubić on "Pula and Western Istria." He made reference to the historical geography of the Peninsula and drew attention to its Illyro-Slav traditions and to its role as a military base in Roman times.

The highlights of the journey to Gorica were an exposition by Professor Melik on the morphology of Istria, demonstrated by reference to spectacular overthrusts of cretaceous limestone on flysch, and a visit to the Skocijanske *iame*, the magnificent grotto at Divači. Dr. Savnik read a paper on the theme of Gorica and the problems associated with the new frontier here. Most of the tributary area of the town is in Jugoslavia, while the centre is in Italy. Other papers read at Gorica included addresses on the theory and practice of Geography by Professor P. Jovanović (Beograd), on the organization of technical work by Professor Melik, and on the foundation of a Central Institute of Geography in Jugoslavia by Professor Sv. Ilešič. There was a paper also on the teaching of geography in Universities (by Professor B. Z. Milojević) and papers on the teaching of geography in technical colleges and schools. On the last day of the Congress an excursion was made northwards from Gorica, into the mountains, to the lake-resort of Bled.

Altogether the Congress was a great success and it was decided to hold another in Macedonia in 1952. The organizers are to be complimented on the staff work necessary to move two hundred and twenty delegates across the new territory of Jugoslavia and to provide them with time for lectures, discussions and official receptions. The enthusiastic welcome given to the Congress by the Jugoslavs living in the new territory contributed substantially towards its success. One came away impressed by the lively spirit of Jugoslav geographers and with rather wistful memories of a surfeit of pork and cigarettes, to which may be added the conviction that geographical congresses are never so successful as when they are held in a land where the vine flourishes. H. R. W.

UNIVERSITY NEWS

THE JOINT SCHOOL OF GEOGRAPHY (King's College, London, and the London School of Economics)

Considerable changes have taken place at the Joint School of Geography since the last note published in the Record of the *Journal* (110 (1947) 133–4). At the London School of Economics Professor L. Dudley Stamp has been elected to the newly created Chair of Social Geography whilst Dr. R. O. Buchanan (from University College, London) has recently been appointed to the Chair of Geography vacated by Professor Stamp. In 1948 Mr. F. W. Morgan, from University College, Exeter, joined the staff as Lecturer, and Mr. D. J. Sinclair, from the Ministry of Agriculture, as an Assistant Lecturer; whilst Mr. K. R. Sealy has been appointed as an Assistant Lecturer from the beginning of this session. An additional assistant Lecturer, Miss A. Coleman, was also appointed to the King's College department in 1948. With Professor S. W. Wooldridge as head of the King's College department, the Joint School is now unique in the country in possessing three professors as well as two readers, five lecturers and three assistant lecturers.

These accessions of strength will do much to cope with the problem of student numbers. Pressure on space still remains an acute difficulty and in the Honours school entry is strictly limited by the available laboratory space. Despite difficulties, improvements in the teaching facilities are gradually taking place. Both departments have recently been redecorated and at King's College a study room for the Final year students has been provided and a departmental geographical library is being rapidly built up under the direction of Dr. H. J. Wood. At King's College also facilities for practical work have been revised under the direction of Mr. W. G. V. Balchin, an improved laboratory has been provided for first year students and much new survey and cartographic equipment obtained.

Field work for Honours students has always been stressed in the Joint School and this year, in addition to numerous local field days and week-ends, no less than four field weeks have been organized. Professor S. W. Wooldridge led a party at Fernhurst in the Weald, Dr. H. J. Wood at Exeter, Mr. S. H. Beaver at Coventry, and Mr. W. G. V. Balchin at Warminster. The past session has also seen the first year's teaching for the new London Honours and Special degree in Geography which affects internal candidates taking Finals in 1951 and thereafter.

Active research work is being undertaken by the staff of the Joint School and recent books and scientific papers published embrace a variety of aspects of the subject, ranging from Land Utilization to Geomorphology, Micro-Climatology and Cartography, Colonial Geography and regional studies in India and Pakistan. Professor S. W. Wooldridge and Mr. S. H. Beaver continue their services as members of the Advisory Committee on Sand and Gravel sponsored by the Ministry of Town and Country Planning. The Joint School has also been doubly honoured in the past session by the award of the Society's Founder's Medal to Professor L. Dudley Stamp and the Gill Memorial to Dr. O. H. K. Spate.

Finally these notes would be incomplete without recording the retirement from King's College, after many years of service, of the Professor of Geology, Dr. W. T. Gordon, who until 1947 was administrative head of the King's College department of Geography. The Joint School of Geography continues to work in close association with the Department of Geology at King's and it welcomes Dr. J. H. Taylor, from the Geological Survey, to the Chair of Geology.

W. G. V. B.

AN INTER-UNIVERSITY GEOGRAPHY CONFERENCE

An Inter-University Geography Conference is being organized by the students of the Geography Department of Birmingham University from 17 to 21 April 1950.

It is an attempt to bring students of geography together from all parts of the United Kingdom, to broaden their interest in the subject by talk and discussion, and also to permit of social contact with members of other universities. Its success will promote the liaison between geography students which is so greatly needed. The Birmingham University Students hope that the conference will become an annual event in the geographical world to which students themselves will contribute the major part. But all students, of whatever faculty, are invited. A civic reception has been arranged by the Lord Mayor of Birmingham. Provisional speakers are Sir Raymond Priestley, Sir E. John Russell, Professor R. H. Kinvig, Mr. M. J. Wise, and Mr. H. J. Manzoni. It is hoped that Professor Griffith Taylor and other geographers will also be present.

The cost for the four days, including accommodation, meals and attendance at lectures will not, it is hoped, be more than £3 10s. Further information may be obtained from Mr. J. N. Jackson, Inter-University Geography Conference, 341, Bristol Road, Birmingham, 5.

A COMMISSION FOR THE STUDY OF INDUSTRIAL PORTS

The Commission on Industrial Ports which was set up at the International Geographical Congress at Lisbon in 1949 decided, at two meetings held during the congress, to prepare a report for publication by the International Geographical Union and also to propose two questions for the special attention of workers in this field. The questions proposed are: (i) factors influencing the location of industries within a port, and (ii) the extent to which the hinterland of a port is influenced by the industries of that port.

The Commission will be glad to hear of work, completed or in hand, which bears on the questions proposed and those who are interested in the subject are invited to communicate with the Chairman of the commission, Professor W. E. Boerman, van Beuningenstraat 18c, Rotterdam, Holland; or with the Secretary, Professor G. H. J. Daysh, Department of Geography, King's College, Newcastle-upon-Tyne, England.

A UNIVERSITY OF CALIFORNIA EXPEDITION TO SOUTHERN ARABIA

We hear that the University of California, which recently sent an expedition to Africa, is now to extend its activities to Southern Arabia. The leader, Mr. Wendell Phillips, has already undertaken an air survey of parts of the Hadhramaut, Dhofar and Oman. This is preliminary to the land expedition which, with Aden as its main base, is planned for the coming winter. Mr. Wendell Phillips will lead a party of fourteen which will include Dr. Henry Field of the Field Museum of Chicago, Professor Allbright the distinguished archaeologist and historian, Father Jamai an authority on Southern Arabian inscriptions, and Mr. Roland Bowen. The expedition, which was due to take the field in October, will be mainly concerned with archaeology and anthropology, although a certain amount of geological and palaeontological work will be undertaken. The main areas to be investigated will be Hadhramaut and Dhofar; Oman will if possible be included, although only one European, Mr. Wilfred Thesiger, has in recent years succeeded in penetrating the Oman borderlands. The expedition will be equipped with four-wheel-drive Chrysler 1-ton lorries. We hope to publish information on its activities in future issues of the *Journal*.

THE INDUSTRIAL DEVELOPMENT OF PUERTO RICO AND THE VIRGIN ISLANDS

The recently published report of the United States section of the Caribbean Commission, "Industrial development of Puerto Rico and the Virgin Islands of the United States," is not so much an account of accomplished industrial development as a statistical survey of a somewhat uncomfortable economic structure, together with an exploration of steps taken and to be taken to improve it. It is of interest because of similar conditions and problems in other islands of the West Indies.

Over-population seems to be the main cause of the *malaise* in Puerto Rico; in the decade 1936–46 the population increased by 19·3 per cent. from $1\frac{3}{4}$ million to well over 2 million, with a pronounced shift from rural to urban communities. The limited resources of the island are incapable of supporting by the traditional forms and methods of production a relatively large and rapidly growing population at an acceptable standard of living. Agriculture, which employs some 40 per cent. of the workers, is pressing upon the limits of productive land and in this industry unemployment in 1947 was over 39 per cent., higher than in any other group. Out of a total labour force of 700,000 approximately 120,000 are classed as engaged in manufacture, but many of these are employed in needlework and other occupations in which the capital investment, productivity and income per worker are low. Since the mid 1930's there has been an Insular deficit on the balance of payments, made good by Federal contributions.

Migration of Puerto Ricans to the mainland and elsewhere is taking place on a small scale, but is quite insufficient to effect a balance, or to drain off the natural increase of population. In spite of the scantiness of mineral and forest resources and the limited supplies of water-power, the main hope appears to lie in an expansion of manufactures. To this end the Puerto Rico Industrial Development Company has been set up, with funds supplied by the Federal Government, to promote any form of industrial development that shows promise of success and of contributing to the welfare of the Puerto Ricans. A similar organization is the Puerto Rico Water Resources Authority vested with powers to control and develop water-power resources. It is recognized that the United States will be called upon to advance considerable sums of capital to the island. "In the early stages of the economic development of an undeveloped or an underdeveloped area it is normal that the greater part of the investment requirements should come from outside the area. In the long run however the economy so developed must show that these borrowings can be repaid."

A short report on the Virgin Islands is added. There is no map. E. W. S.

THE CAMEROON HIGHLANDS

The current issue (Number 31) of *Nigeria* is devoted almost entirely to an account of a motor journey through the United Kingdom Trusteeship Territory of the Cameroons, only recently connected by road with the Colony of Nigeria. The narrow winding road through the highlands enjoys an extreme form of one-way traffic: Mondays, Wednesdays and Fridays, uphill; Tuesdays, Thursdays and Saturdays, down. Written in simple language, and evidently for readers in West Africa, the article contains much useful information on this isolated region of mountain climate and topography and is illustrated by nearly a hundred excellent photographs and a sketch-map. *Nigeria* is published quarterly by the Government of the Colony and may be obtained in England from the Crown Agents, price 1*s*, or 1*s* 6*d* post free.

THE WORLD'S LONGEST RIVERS

Of the longest rivers in the world, five are found to stand apart as over 3000 miles long, with a gap of nearly 500 miles between them and the rest. The "big five," named in the usual continental order, are the Yangtze Kiang and Yenisei (Asia), the Nile (Africa), the Mississippi-Missouri (North America) and the Amazon (South America). There are wide variations and some suspected overstatements in their published lengths—particularly for the "Missourippi." I have therefore carefully measured the length of each river to its remotest source (irrespective of name), including the estuary and any intervening lakes, on the 1/M United States Air Force 'World Aeronautical Charts,' supplemented (for the Amazon) by the American Geographical Society's sheets of Hispanic America on the same scale. The courses were stepped at 5-mile intervals, or at 2-mile intervals on the smaller and more frequent bends of the upper reaches. Where enclosed islands offered alternative channels differing appreciably in length, the shorter was measured, unless the longer had some town or marked a boundary. The results of these measurements are shown in the accompanying table, the lengths being to the nearest 5 miles. The column headed "net addition" relates to the difference between the longer and shorter channels round included islands; the "adopted length" includes the longer channels. The geographical coordinates of the remotest source, on which these measurements are based, are also shown.

River	*Shorter length*	*Net addition*	*Adopted length*	*Source*	
Amazon	3960	90	4050	15·4° S.	71·9° W.
Nile-Kagera	3910	20	3930	3·7° S.	29·9° E.
Mississippi-Missouri ..	3660	100	3760	44·6° N.	111·5° W.
Yangtze Kiang	3450	50	3500	34·2° N.	90·5° E.
Yenisei-Selenga	3350	0	3350	48·0° N.	97·3° E.

The tabulated lengths confirm the suspected overstatement in the length of the Mississippi-Missouri; the Amazon is therefore the world's longest river, measured from its remotest source, lake Villafro at the head of the Ucayali–Apurimac arm. The real size of this branch was unknown when Wallace decided a century back in favour of the Marañon branch,[1] 1105 miles long and navigable for 535 miles from its junction 2385 miles upstream. The Amazon has seven tributaries over 1000 miles long as well as the Madeira (2270), the Purus and the Jurua (almost 2000). The Amazon is the world's most "extensive" river, besides having the longest main course which is navigable for 3570 miles. The estuary is 100 miles long and the delta another 200 miles.

The source of the Nile is taken as that of the Luvironza branch of the Kagera river, flowing into Victoria Nyanza from the south-west. The Nile is navigable for 635 miles, to the first cataract. The main channel of the delta is 140 miles long and the "net addition" of 20 miles includes the 10 miles extra along the delta channel to the Damietta mouth. The Nile has one outstanding branch, the Blue Nile, 1060 miles long from the source of the Mogach flowing into lake Tana from the north.

The upper Mississippi may be considered as an arm of the Mississippi-Missouri 1075 miles long from its source, lake Itaska, to the junction of its lower course with the Missouri, 1285 miles from the Gulf of Mexico. The Arkansas, joining the lower Mississippi 605 miles up, is however the longest

[1] See the writer's fuller note on this point, *Scot. Geogr. Mag.* 34 (1918) 391.

branch, being some 1360 miles long. The Missouri source adopted is the main Red Rock source of the Jefferson river. The delta channel may be taken as 30 miles long. Navigation ends at the Great Falls, 3360 miles up river.

The source adopted for the Yangtze Kiang is that of the Murren head-water, though the sources of the Chumar and the Murui Ussu are virtually as distant (the tabulated length has been increased to the nearest round number owing to the indefiniteness of the source). The estuary is 100 miles long. The Yangtze would lose 40 miles in the alternative course across the north end of the Tungting lake, by omitting the tortuous bends to the northward. It is navigable for 1660 miles.

The Yenisei, like the Mississippi, finds its greatest length continued under the name of its right bank tributary, the Angara (Upper Tunguska) through lake Baikal and thence up the Selenga, the upper Yenisei being regarded as a branch 1105 miles long. The total length given should cover any indefiniteness as to which stream is the remotest source of the Selenga. The longest branch of the Yenisei is the Lower (Nizhnyaya) Tunguska, 1620 miles long. The Yenisei is navigable (in summer) for 1780 miles; its estuary is 270 miles long.

So much for the "big five"; the next group of six comprises the Ob-Irtish, Congo, Lena, Amur-Argun, Mackenzie and Hoang Ho. Then there is a group of three, the Mekong, Niger, and Paraná-Plata. The Volga completes the list of the world's rivers over 2000 miles in length; fifteen in all. (The measurements for the rivers above named have been made on maps of smaller scale.) The continental distribution of the fifteen great rivers is shown below.

Lengths in miles	*Europe*	*Asia*	*Africa*	*North America*	*South America*	*Total*
4050–3350	—	2	1	1	1	5
2920–2740	—	4	1	1	—	6
2560–2450	—	1	1	—	1	3
2150	1	—	—	—	—	1
Total ..	1	7	3	2	2	15

In conclusion, the world's rivers may be placed in their order of greatness in two other respects, by drainage area and by discharge. The six draining over a million square miles are, in order: Amazon, Congo, Mississippi-Missouri, Ob-Irtish, Nile, and Yenisei; the basin of the Amazon (2¾ million square miles) being nearly double that of the Congo. The six with a discharge of over 100 cubic miles per annum are: Amazon, Congo, Paraná-Plata, Mississippi-Missouri, Yangtze Kiang, and Orinoco. The Amazon (527) and the Congo (419) are more than double the next in the list. On each score the Amazon heads the list, having a basin nearly twice as large as that of the next, and, in discharge, standing with the Congo quite apart from the rest. It is remarkable that South America should claim three of the big six for discharge, while the Amazon leads on every score. This fluvial preeminence is due to the build of the continent, with its great plains facing the easterly trade winds ere they strike its great Andean backbone.

O. R. WALKEY

UNGLACIATED ENCLAVES IN GLACIATED REGIONS

To *Irish Geography* (Vol. II, no. 1, 1949) Professor D. L. Linton contributes an illuminating article on *nunatak* and other unglaciated surfaces in the glaciated parts of this country and Scandinavia. The study exemplifies the great care which must be taken in the light of modern knowledge before drawing inferences concerning the past history of rocks with respect to ice-action, and the

importance of considering British glaciological problems in relation to those in a neighbouring land of higher relief like Scandinavia. The article is really a sequel to a paper by Dr. Farrington on "Unglaciated areas in Southern Ireland" (*Irish Geography*, 1947) in which he points out the absence of drifts and transported boulders in a number of upland tracts stretching across the country from Dingle Bay to Dungarvan Bay. Dr. Farrington's conclusions are based only on negative evidence, whereas Professor Linton reviews the positive evidence for unglaciated surfaces in different parts of Northern Europe. In the first edition of James Geikie's 'Great Ice Age' (1874), reference is made to unglaciated enclaves in the Southern Pennines, but the most important work on this subject has been done in Norway. There the unglaciated features comprise, in addition to the higher mountain nunataks of the peninsula, a number of plateau remnants of various sizes in the Lofoten Islands and in Finnmark ranging from about 500 feet to 3000 feet in altitude. Some of these plateau surfaces which, however, harbour corries due to local glaciers, are demonstrated to be of pre-glacial origin. Ahlmann is quoted as referring to them as "parts of a mountain topography advanced to old age" and Undaas as insisting that an eroding ice-sheet is selective in action, leaving behind a broken terrain, and could never have shaped the smooth flowing outlines of these peneplane-like forms. The latter moreover have not only the outlines resulting from normal erosion, but are actually covered by the products thereof. It is concluded that "long flowing outlines," whether in Norway, Scotland or Ireland, are essentially of pre-glacial origin and that care must be exercised not to confuse this kind of landscape with such rounded or smooth contours as may actually be due to ice-sculpture.

Professor Linton adds an original contribution of his own, based on many years' work in the Scottish Highlands, relating especially to the significance of the tors in North-East Scotland which could hardly have survived the passage across them of a sheet of moving ice. The classic ground of tors in the British Isles is of course Dartmoor, which is known to have lain outside the British ice-sheet, though there is some evidence that this Devonshire highland underwent local glaciation, as would indeed be inferred on purely climatic grounds. The tors which crown some of the high Cairngorm summits resemble those of Dartmoor in showing the effects of deep weathering, but differ in being masked by the forms produced by local glaciation. Unlike the Western Highlands which were submerged beneath an ice-sheet, the eastern Grampians exhibit only localized ice-action—in the corries, troughs and certain valleys. If ice did pass over the eastern mountains its effects must have been depositional rather than erosive. The significance of the Cairngorm tors is strengthened by the occurrence of similar "tower-form erosion remnants" (to quote Nordhagen) in Norway, and of "pillars" in those parts of the Ural mountains which according to the 'Great Soviet Atlas' escaped glaciation. Professor Linton observes that though the best-known examples of tors are built of granite they are by no means confined to that rock or even to the acid intrusives. The writer of this note was certainly struck by the fact that the dark micaschists which form the impressively jagged coast between Bolt Head and Bolt Tail in South Devon have weathered into shapes on the cliff plateau very much resembling in general appearance, if not in structura ldetail. the granite tors of Dartmoor itself.

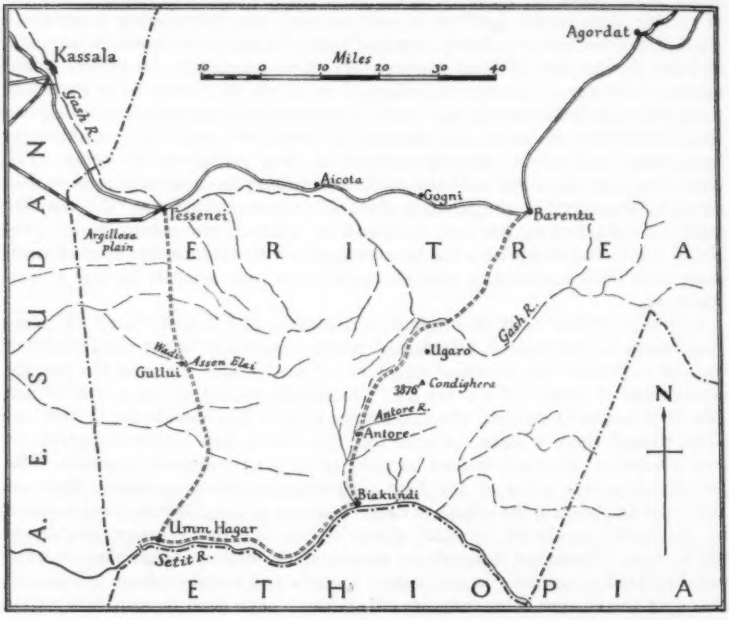
L. C. W. B.

THE WESTERN BASSOPIANO DISTRICT OF ERITREA

A part of Eritrea which has been but little visited since British forces occupied the territory in 1942, is the Western Bassopiano District which lies in the angle

formed by the junction of the Sudan and Eritrea border with Ethiopia. The area is bounded on the north by the river Gash, or Gasc, and on the east by the track running north from Biakundi through Ugaro to Barentu. The Italians constructed the roads round the area to supply their frontier posts before the invasion of Ethiopia, but since the British occupation they have not been used and, although the Sudan Defence Force carried out a certain amount of maintenance work in 1943, they have not been repaired since. They have degenerated into seldom-used camel-tracks, or have merged with the bush and disappeared.

Leaving Tessenei early this year in a Jeep and trailer a party of two officers, with a driver and a guide, took the track south towards Umm Hagar. It is a



well-marked track and easy to follow as it is used in the dry season by heavy Italian diesel lorries bringing coffee and dura from Umm Hagar and Gullui. From Tessenei as far as Gullui, about half-way to Umm Hagar, the track crosses flat scrub country which is impassable in the wet season because the surface is largely of loose cotton-soil and there are many shallow water-courses running from the hills to the east, some of which rise to a height of more than 1000 feet above the Argillosa plain. There are large areas of cultivation here, the main crop being dura wheat. One mile beyond Gullui, a collecting centre for the crops grown around it, is the first large water-course, the Wadi Assen Elai. Here one begins to meet members of the Beni Amer tribe, a nomadic people, who move around this area in the winter with their cattle. The country is covered with low scrub and occasional patches of dura, the ground rougher and considerably more broken owing to the numerous small channels which have to be crossed. There is a gradual climb out of the Gash basin into low

granite hills; the rocks are often split cleanly along structure-lines as a result of block-disintegration. The track, which was reasonably straight from Tessenei to Gullui, is now twisting and tortuous as it threads its way through the hills; and less well defined on the harder ground.

The approach to Umm Hagar is marked by long, low hills on either side of the track which widen out into the Setit valley. They are of dark, volcanic rock and present a curiously flat sky-line. Umm Hagar was formerly a village of about 3500 inhabitants, but now gives the impression of being smaller; a liberal estimate would probably be nearer 1000. The reduction is in all likelihood due to the fact that since their liberation the Abyssinians have indulged in raids across the border at this and other points and many Eritreans have moved farther into the territory. The village is typical of others in the district, the huts being of wood and dura stalks and petrol tins beaten flat. Several buildings in the centre of the village were constructed by the Italians, but these are now used as a market. The natives take no pride in their dwelling-places and, compared with their Sudanese neighbours, excel in no craft with the possible exception of leather-work. The general picture is one of neglect and decay, as with much of the rest of Eritrea. There is no prosperity here; only bare subsistence.

From Umm Hagar there are two tracks: one towards Biakundi and one to the Sudan border. Some two miles along the western track is a turning to the Setit, which is about a mile away. Here the Italians almost completed a seven-span bridge across the river; which the existing maps either do not show at all, or mark three or four miles to the east of Umm Hagar. It is a steel girder structure built on eight stone piers. The centre piers are about 30 feet above the bed of the river and in the rainy season the water-level is only a few feet from the road surface. The Setit at this point runs in a wide shallow bed, obstructed by ugly-looking rocks.

In the first four miles from Umm Hagar on the eastern track there are three villages (Teina, Surona and Koraena) which are progressively poorer and more ramshackle; the inhabitants were obviously scratching a bare existence from the soil. Most of the villagers have been moved farther into Eritrea because of the raiding already mentioned. At intervals along the route the old Italian track is visible, and occasionally the Setit can be seen through gaps in the thick vegetation. The old road is overgrown with dom-palms, thorn-bushes and other scrub. Regular piles of stone ballast and many small cuttings and embankments seem to indicate that the Italians intended to build a railway, the cost of which would however have been prohibitive for any except purposes of war. Nevertheless the Italians had put a considerable amount of work into the route and there are many bridges and culverts across the smaller wadis; those across the larger *khors* have long since been washed away. To the north of the track runs a river-terrace varying from approximately 50 to 100 feet above the river; and cut into by the larger *khors* which have their sources farther north. The vegetation is typical of tropical Africa. Wild life there is in plenty; several species of gazelle, and kudu, dik-dik, crocodile, and wild boar were seen, and there were reports of lion, panther and elephant.

Biakundi consists of one ruined, blitzed house standing on a small knoll overlooking a considerable stretch of the Setit and the Ethiopian border. For some thirteen or fourteen miles the Ugaro road is good and reasonably flat. Here one reaches the village of Antore, where the villagers from Biakundi were evacuated because of the depredations of the Abyssinians. The village, at the confluence of the Adamo and the Antore rivers, is apparently prosperous, the villagers owning large herds of cattle and goats and growing a fair amount of

grain. From here the country is broken and hilly as one climbs to the water-shed. It is more thickly wooded than round Antore and more retentive of moisture; the grass and scrub are greener. Occasionally there are signs of the Italian retreat: an abandoned vehicle, a couple of stone pillboxes, an artillery position. The water-shed is about 25 miles from Biakundi and the descent into the Gash valley starts at Condighera. There are still indications of the Italian road.

Ugaro is visible some 2 or 3 miles away, perched Italian fashion on the shoulder of a hill. On a nearby hillside are excavations in connection with an Italian gold mine. The mine is not now worked, for after the British occupation the Italians began to return to Italy and there is insufficient labour. Ugaro, like several of the once busy outlying townships, is a ghost. From Ugaro to Barentu the road rapidly improves, the map becomes reasonably reliable and a guide unnecessary.

P. H. SOAR

CHRISTOPHER SAXTON'S DATE OF BIRTH

The date of Christopher Saxton's birth was the subject of a recent note in the *Journal* (112 (1948) 256). Having been born either in 1542 or 1544, he could not have been a pupil of Wakefield Grammar School, which was not founded until 1591. To my inquiry of numerous "old boys" who attended the school under Mr. M. H. Peacock's head-ship, none can remember his claiming Saxton as being either Wakefield born or a pupil of that school. The evidence that "Christopher Saxton of Dunningley" was born in that hamlet, standing on a bold promontory midway between Leeds and Dewsbury, is overwhelming. The exact date of his death, *circa* 1610, remains unsolved. "The Topcliffe & Morley Registers," edited by William Smith, F.S.A.S., states that in all probability Saxton was buried at Batley Church. I have inspected the registers including an entry "Ano.Dm.1609: The buryings in this year—and for five years following—are not to be found." Could these records reappear, they might throw light on the question of Saxton's exact age.

R. H. NORTH

THOMAS CARLYLE AND ELISHA KENT KANE

The memory of Elisha Kent Kane's arctic expeditions of a hundred years ago is recalled by the recent presentation to the Carlyle Museum in Chelsea of a copy of William Elder's 'Biography of Elisha Kent Kane.' [1]

Returning in 1851 from the unsuccessful American expedition under De Haven in search of Sir John Franklin, Kane, who had been surgeon on that expedition, immediately set about preparing a second for the same purpose. He sailed in the brig *Advance* in 1853 and passing through Smith Sound at the head of Baffin Bay entered the enclosed sea which now bears his name: the Kane Basin. After enduring great hardships he was forced to abandon his ship in the ice and the party reached Upernivik in North Greenland in August 1855. He received one of the Society's Royal Medals in 1856 and a eulogy from the then President, Sir Roderick Murchison, but died in the following year at the early age of thirty-seven.

This copy of Elder's biography bears the inscription: "Thomas Carlyle Esq. with the respects of William Elder, Philadelphia, U.S.A." and also the autograph "John Welsh."

That Carlyle read the book with little approval is obvious from the pencil notes in his handwriting scattered throughout its pages. One comes to the conclusion however that it was not the explorer that Carlyle was criticizing, but

[1] William Elder, 'Biography of Elisha Kent Kane.' Philadelphia: Childs and Paterson; London: Trübner, 1858.

the author of the book whose eloquence evidently jarred upon him. Some of the notes are trivial, such as "authordom" altered to "authorship," and " I will " altered to "I shall," but the remark "what a hero" on page 154 shows that Carlyle had rather sad memories of his own experiences of public lecturing. Kane mentions that the money received from his lectures in Boston, after his travelling expenses had been deducted, amounted to $1400. Carlyle writes "£280" in the margin, he would now have to write nearly twice that amount.

Of the North West Passage the author says: "the search for it has given us the geography and natural history of almost all the land marks of the Western hemisphere; and the long endeavour has fully repaid all the incident expenditure of wealth, labour and life, so generously lavished upon it." Carlyle has crossed out the word "land" and substituted "ice"; against "fully repaid" he writes in the margin: "Where, then, or when, or how?" Again, referring to the lives and treasure expended in the search, Carlyle bluntly remarks: "It has got this noisy blockhead Book out of it, for one thing."

At the end of the biography proper Carlyle has written: "I seldom heard a madder bubble of nonsense (due chiefly to the enarchic American *Public*. I perceive) than the whole of this business abt. poor Kane is, life led by him, rumour raised round him, Book written abt. rumour of him. A very mad world indeed."

As the name on the front page shows, the book came from the library of a cousin of Jane Welsh Carlyle, John Welsh, who was appointed Superintendent of the Kew Observatory in 1852. Among his mother's friends was a Mrs. Whipple, the wife of G. M. Whipple who also became Superintendent of the Observatory. Her third son, Francis John Welsh Whipple, himself Superintendent of the Observatory from 1925 to 1939 received the book from Mrs. Welsh. He died in 1943 and it now returns to its home in Chelsea. R. S. W.

OBITUARY

EDMUND JOHNSTON GARWOOD

Professor Garwood died at his home in Hampstead on 16 April 1949. Born in 1864, the son of the Rev. William Garwood, he will long be remembered by geographers, largely in connection with his studies of glaciers and glacial phenomena.

On leaving Eton, he studied chemistry and physics at Cambridge, but soon he became fired with a love of geology and attended field classes by Professor T. McKenny Hughes and lectures by Dr. J. E. Marr with whom he became a close friend. In 1886 he was elected a Fellow of the Geological Society of London. After leaving Cambridge he intended joining the staff of the Geological survey at the suggestion of Sir Archibald Geike, but in 1887 his uncle and guardian died and he took his place as partner in the Jarrow Chemical Company. For four years he remained director until its incorporation in the United Alkali Company left him free to follow his natural bent. In 1891 he was invited by the Cambridge University Extension Lecture Syndicate to undertake a geological lectureship. For some years he continued this work mainly in the north of England, and then joined the teaching class of the newly formed Army Class at Harrow School.

His first geological paper, on the Magnesian Limestone of Durham, was published in 1891. It was his interest in these northern districts which inspired him to make a detailed study of the stratigraphy and palaeontology of the Carboniferous Limestone, and his work on the Lower Carboniferous rocks became the basis of stratigraphical zoning in the North of England.

In his younger days Professor Garwood spent much time at his uncle's villa on the shores of Lake Como and became interested in exploring the Alps—he became one of the best-known climbers in the Engadine and in other areas in Switzerland. These visits to the Alps first aroused his life-long interest in snow and ice, and in 1896 he accompanied Sir Martin Conway's expedition to Spitsbergen where he studied glacial phenomena and geology. For this work he was awarded the Gill Memorial Fund by the Royal Geographical Society and the Wollaston Fund by the Geological Society of London. A tour of Kangchenjunga with Mr. Douglas Freshfield followed in 1899, where he continued his work on ice and snow and their related geological and physiographical phenomena. His many visits to the Alps assisted him in his glaciological studies and he became a champion of the protective theory of glacial erosion from which his well-known ideas concerning hanging valleys in the Alps and Himalayas evolved.

In 1901 he accepted the Yates-Goldsmidt chair in the University of London and remained professor of geology and mineralogy at University College until his retirement in 1931. Subsequently he was Emeritus Professor. For seven years, 1905–1912, he was Honorary Secretary of the Geological Society of London and President from 1930 to 1932. In 1914 he was elected a Fellow of the Royal Society. He was president of the Geographical Association in 1913, and in 1915 was awarded the Lyell Medal of the Geological Society. During the First World War, Professor Garwood was asked by the War Office to compile maps of the Italian Alps, which he knew intimately, to show sources of water-supply and other features of military importance. These maps were used by General Plumer, Commander of the British Expeditionary Force

which was sent to assist the Italians after the disastrous defeat by the Austro-German army at Caporetto in 1917.

Much of his later life was devoted to the organization of the Geological Department of University College, London, and in the building up of its collections. His great enthusiasm infected the many students who had the good fortune to study under him. He gave much of his time and energy to his students, not only in their official studies at the University, but also in private attention and in field work. He also assisted the Geographical Department of the College by taking over the lectures in physical geography.

Professor Garwood became a Fellow of the Royal Geographical Society in 1898 and served on the Council from 1914 to 1918; a member of the Geographical Club since 1902 he was, until recent years, a regular attender at its dinners. Scientifically, he will be remembered primarily for his work on glacier study and its attendent geological and physiographical phenomena, for his work on the Lower Carboniferous Rocks of Northern England and for his palaeobotanical studies of Palaeozoic calcareous algae. Personally, he will be remembered as a good friend, a modest and sympathetic teacher and as a true gentleman.

C. D. O.

FRANCIS SYDNEY SMYTHE

The untimely death of Frank Smythe on June 27 last at forty-eight years of age was a shock to the mountaineering world, and the more so in view of his recent departure for another Himalayan enterprise. Taken ill in Delhi with severe food poisoning, he was on his way to Darjeeling when he was struck with a virulent attack of malaria. Conveyed home by air by his wife, he made some progress towards recovery but succumbed to another attack of fever. Frank Smythe was delicate from a boy, and never developed into a robust type. Yet his amazing spirit, and a peculiar wiriness, carried him through feats of mountain endurance, which were the marvel, and often the undoing, of some of his companions. I once travelled back from India with a Wing Commander who had been his instructor, when Smythe for a time was in training for the R.A.F. I was asked if it were true that Smythe had performed all the feats reported of him on Everest and elsewhere, for he had never shown the slightest capacity for such things when in the Service, and actually had been invalided out with a weak heart.

As a boy, after a period at Berkhamsted School, he was sent for his health to Switzerland, where he acquired his love of mountains and a high degree of skill in mountain-craft. Zürich, too, provided him with part of his training in electrical engineering, which later took him to Argentina. But he never really wished to be an engineer, and he soon returned to England to engage in a severe struggle to establish himself in article-writing, relating chiefly to his Alpine and British mountaineering experiences.

The Alps had lit a flame in him, but it was the Himalaya which later fanned that flame into full effulgence. The international expedition to Kangchenjunga in 1930 gave him his first taste of Himalayan mountaineering, followed next year by his first ascent of Kamet (25,447 feet), and three successive expeditions to Mount Everest in 1933, 1936 and 1938, which, with an independent botanical enterprise in Garhwal, and the "Valley of Flowers," in 1937, together make up a very comprehensive record of Himalayan travel. The result of these journeys and his Alpine experiences, was a remarkable succession of books, which in later years were appearing in almost too continuous a stream, and errors and omissions were not at times infrequent. Many were virtually albums of

beautiful photographs, with text as commentary; for Smythe had won his way into the front rank of mountain photographers.

His last venture but one took him in 1947 to the far northern Canadian Rockies, where in the pioneer ascent of Mount Lloyd George, in which the writer had the pleasure of taking part, he evinced again not only his enthusiasm for first-class climbing as such, but his intense admiration for the surprisingly prolific flora, a large number of specimens of which he brought back. He had enriched Kew and Edinburgh with his Himalayan finds, and now the Botanic Garden of the latter received an important northern Canadian collection. The collecting of mountain plants had indeed become the chief adjunct of his climbing enterprises, and as a result many of these plants, particularly from the Himalaya, have been acclimatized and introduced into English gardens. His own beautiful garden in Sussex, on the border of St. Leonard's Forest, was especially rich in Himalayan rhododendrons.

His technical skill as a mountaineer, and his record of accomplishment, will undoubtedly be related elsewhere. Here it is sufficient to say that by four of his achievements, irrespective of all others, Frank Smythe has placed himself in a foremost place amongst mountaineers of all time: the conquest of Kamet, which stood for a time and until 1936 the highest peak ever ascended; the ascent to, and return from, 28,000 feet on Everest in 1933; the guideless descent in a snowstorm of the unclimbed Peuteret precipices of Mont Blanc; and his guideless re-ascent of the Lochmatter route on the Plan de l'Aiguille, for years reckoned as the most difficult climb in the Alps, and one which, as Mr. G. Winthrop Young has declared, is never likely to be surpassed as a pure climbing feat now that mechanical aids are so often brought into use on such ascents.

Smythe may by some have been regarded as a fanatic. An extreme enthusiast he certainly was: for a fire burned within him, and the spirit of the mountains imbued him and carried him on. But, by his many writings, his extensive lecturing, and his supremely beautiful mountain photographs, he has played a most important part in reviving and promoting the spirit of adventure, of enterprise and initiative, so vital to our youth at the present time.

N. E. ODELL

LUCAS BRIDGES

[We have received the following note of appreciation of the late Mr. Lucas Bridges from Colonel Charles Wellington Furlong of Cohasset, Massachusetts.]

The April *Geographical Journal* contained a review of a great book by a great man, E. Lucas Bridges, of Tierra del Fuego. After Bridges it fell to my lot to be the first explorer and American, alone with the Ona, to cross Tierra del Fuego through the heart of the Fuegian jungle. I have slept beside Bridges under the same guanaco skin in the Fuegian rain forest and visited him in Buenos Aires this spring, but six weeks before he passed over the Great Divide. After a friendship of forty years, perhaps I am privileged to evaluate somewhat intimately both his work and character.

Well built, Lucas stood 6 feet 2 inches, with the slight forward stoop of the alert woodsman and the walk of the American Indian. These physical characteristics symbolized his character—a tolerant, strong universality of mind, ever forward looking to new creative purposes and adventures, toward which he moved with sure determination.

Bridges' association with the Ona was unique. Men living the life of the

Stone Age, each regarded every man outside of his own small family group as an actual or potential enemy. The denseness and difficulty of travel of this sub-Antarctic rain-forest jungle must be experienced to be realized. Into this unknown wildness Lucas Bridges went alone, the first white man to contact these southernmost inhabitants of the world, and to ingratiate himself into their respect and confidence, and *hain*, their tribal lodge.

Not only in his relationships with the primitive but with all men, he displayed the same qualities of unusual courage, psychology and tact. He had a happy, optimistic disposition, was a believer in God, hence a believer in himself. Though gentle and kindly among his family and friends, he was a man not to be trifled with.

Not content with hewing two homes out of the Fuegian jungle, he pioneered in the southern Andes in 1917, opened a large tract of land behind the Gulf of Peñas, built bridges over chasms, navigated unknown rapids of the Baker river and broke a new trail to the Pacific. Leaving Charles Wood as manager, he joined the colours in England, where he married Jannette McLeod Jardine and after the war settled down with his wife and little daughter, with three acres of land and a car. "But," as Bridges wrote, "life was too easy. I looked towards the Dominions and finally determined on South Africa." Here, on land marked "Unsuitable for White Men," Devuli Ranch was established.

Then he had to hasten back to the Andes. There had been cattle lifting—neglect and worse. Wood, the manager, had been stabbed to death. Hundreds of thousands of pounds of indebtedness had piled up. Bridges personally took over and got the shipwrecked venture off the rocks, a stupendous achievement, but with modesty characteristic of the man he briefly wrote, "Suffice it to say that I had a lot of fun up there and now the place is on its feet."

Bridges epitomized the highest type of the true pioneer. "The only work I felt fitted for," wrote Bridges, "was breaking new trails, reclaiming unused land; and the thought of the thousands of leagues in distant parts of the world unpeopled and producing nothing continually troubled me." His ear was always attuned to that everlasting whisper,

> "Something lost behind the ranges
> Lost and waiting for you. Go!"

As an American I count it an honour to pay tribute to this Englishman whose record stands as that of the greatest pioneer of his generation, and of one who has upheld the noblest Anglo-Saxon standards and ideals upon which Western Christian civilization is based. These form the spiritual cement which will unite our two countries in increasingly stronger bonds of friendship, understanding and common world purpose, essential to our survival and Peace.

CORRESPONDENCE

GEOGRAPHY AND LITERATURE

Hard words break no bones, and British professional geographers have been accustomed to abuse these fifty years. At first it was because they were too ambitious and wrote or studied such works as 'Geography and World Power,' 'Man and his Work,' 'The Influences of Geographic Environment,' and so on. Now (according to your correspondent Mr. Giffard) the reverse is the case. They are too timid and apathetic. They write narrow and pedantic stuff in a jargon which no one but themselves can understand, instead of turning out "Books . . . which could inform the statesman, the soldier, the administrator . . . about the world in which they live." Mr. Gifford is, we believe, a member of a publishing firm, and it is pleasant to picture him calling upon Mr. Churchill or Field-Marshal Montgomery with "Here is a book which will tell you about the world in which you live, written to order by Geography-Professor *X*." But we ourselves prefer to be courteously firm in declining to write 'Geography for the Million.' We think the bricks must come before the house.

As to terminology Mr. Giffard would limit us to the vocabularies of fifty years ago, as employed by Mackinder and Herbertson. But why not a hundred years? Let the canon be the works of Herschel, Mary Somerville, and Bates.

Next time Mr. Giffard should try the carrot, not the stick. Our hides are too thick.

E. G. R. TAYLOR

3 *October* 1949.

I should like to support Mr. E. O. Giffard's plea for a larger number of geographical books of literary merit in which technical jargon is eliminated as far as possibie. Such books should indeed have the same popular appeal as those dealing with scientific or historical subjects in a non-academic manner. The adoption of special terms may on occasion be justified by the desire for precision; but where familiar expressions adequately cover one's meaning it is foolish to introduce unfamiliar words and phrases which require elucidation for the layman.

There has been an increase in recent years in the introduction—even the invention—of a special terminology for geographical works. But geographers should seek to emulate the recent trends in historical literature in preference to a repetition of the aims of the historians of half a century ago. Historians of the calibre of Hume, Robertson, and Gibbon in the eighteenth century, Macaulay and Carlyle in the nineteenth, established historical writing as a vital and attractive branch of literature, although in some instances it can now be criticized (in the light of modern techniques) as lacking in scientific method and faulty in interpretation. Some fifty years ago, however, an anti-literary or pro-scientific movement in historical writing, initiated in the Universities, was at its height. As G. M. Trevelyan has pointed out:[1] "History books were henceforth to contain only the learned talk of historians with one another. If the public sometimes overheard that talk, so much the better, but that was a matter of secondary importance. History was to have nothing to do with literature. It was a science, no less and no more." Substitute "Geography" for "History" and the passage is applicable to the present.

[1] In 'History and the Reader,' the Third Annual Lecture of the National Book League, 30 May 1945.

Historians in general have seen the light, and their presentation of historical works in readable form is deservedly appealing to a growing circle of the reading public. Geography, like History, deals with Man in his environment. If the historian can offer the results of his labours in a form attractive to the non-specialist, surely the geographer can make his products equally palatable. Even in geography books dealing with purely scientific aspects of the subject, lucid description and the use of simple words in place of academic terminology could offer to the general reader works of both literary and geographical value. To quote Trevelyan again: "History must be the basis of humane (that is non-scientific) education in the future. Without some knowledge of history other doors will remain closed, or at most ajar." One can claim a similar—perhaps even greater—importance for Geography in the modern world, and our writers must aim at the sound education of their fellow countrymen in things geographical.

EDWARD V. LANE

24 October 1949. *Principal, Lancaster Training College, Lancaster*

MEETINGS: SESSION 1949–50

The following were elected to Fellowship and Associate Membership of the Society on 14 September 1949:

Fellowship: Captain George Astbury; Major R. G. Attwood, O.B.E.; Thomas Bamber; Miss Eileen P. Banks, B.A.; John M. Bechervaise; Captain L. M. Bloom; Graham F. Burley; Dr. Sheila T. E. Callender; Edward B. M. Campbell, B.A.; Rev. George E. Deans; Anthony D'Souza, M.A.; Major Paul S. Fowler, B.SC.; E. F. Haydon; Robert W. L. Holmes; Lieutenant-Commander C. H. Hooper, R.N.R.; Rev. O. A. Rees Hughes, M.A.; John Irwin; Rev. A. R. Johnston; Edward Kettell; Christopher P. Kirby; William Crawford Knox; Chung Tak Kwong, B.A.; Alastair Lamont; A. de C. Le Merle; Charles W. Leverett, M.B.E.; John M. McSwiney; Osmund Kersie Mather; Mrs. Nicole Maxwell; Frank Maynard; Jacob C. Menakaya, B.A.; Miss Anne H. H. Moore; Charles P. Mountford; James Robert Muir; Captain Gavin S. Murray; Hugh A. R. Page; Adrian John Peters, M.A.; Professor Hans Pettersson; Derek Michael Poole; Lieutenant-Commander Neville Rothwell, R.N.V.R.; Henry W. Simpson, B.A.; Aubrey Singer; Nicol Smith; Lieutenant-Commander James A. Stobart; P. W. Stone, B.A.; Euryn Wyn Thomas; Rev. W. John Thomas; Edward Vidal; Ernest Albert Vine; Captain L. G. Waller; Ernest W. Walton-Lewsey; Maxwell N. Wilcocks; Denis Alexander Wilkins; Graham Francis A. Wilmot, B.A.; Major Edgar G. Wise, R.E.; Eric Norman Wraight; William George Wright.

Associate Membership: Charles E. F. G. Chilton; Brian B. Tatford; John Lewis Dixon.

First Meeting, 17 October 1949. The President in the Chair

Paper: Travels in Central Oman. By Mr. Wilfred Thesiger

Elections to Fellowship: Nafis Ahmad; Charles Appleton; Rev. H. W. O. Atkins; John H. Aworth; Dennis John Blake; William T. Bradford; Miss Margaret Coleman, M.A.; Peter Cresswell; Basil N. Crosby; David Hywel

Davies; David Allen Davies; Major William C. Dowell; John A. Dwyer; John Upham Firth; Samuel Wilson Gaffikin; Rev. John Robert Gartry; Bernard Henry Geddes; Ernest N. Gilbert; Dr. John Callis Hawksley, C.B.E.; Henry Norman Haynes, B.A.; John Duncan Heys; Mrs. Eleanor I. Hillier; Donald M. Hunter; James Kenneth Jackson, B.SC.; Miss Nora Jackson; Rev. David E. James; Brigadier H. A. Joly de Lotiniere, R.E.; Miss Pamela Joy Laing; Mrs. E. A. Lofts-Jackson; Eric James Margrett; Guy Micklethwaite, O.B.E.; John Sotham Miller; Raymond Joseph Moore; E. A. E. Nichols-Roth; Alan Durward Nicholls, B.SC.; Leo R. O'Higgins, M.C., M.R.C.V.S.; Rev. Edgar Pearson, H.C.F.; Nicholas Papafilis; Norman Pye; Arthur R. Rouse; Maurice E. Sier; Captain John L. H. Slade; Ladipo Solanke; Captain Anthony Tait; Ralph M. Tinkler; Harold White; George H. Digby Williams, B.SC.

Transferred from Associate Membership: Cyril Ernest Everard; Denis Walter Hill; Charles W. P. M. Redway; Gordon Douglas Smith.

Elections to Associate Membership: John Henry Bishton; Miss Monica P. Bunt; John Hepburn Illingworth; Hugh Counsell Prince.

Second Meeting, 31 October 1949

Films: Subantarctic weather station. Films with commentary by W. A. Scholes

Third Meeting, 7 November 1949. Professor J. A. Steers in the Chair

Paper: Graded rivers. By Professor D. L. Linton

Fourth Meeting, 14 November 1949. The President in the Chair

Elections to Fellowship: T. K. Batty; John H. Boreham; Derek G. A. Bunker; David A. Clee; Paul Clifton; Peter Graham Cobb; John Lloyd Davies, M.A.; Miss E. Mackenzie Dean, B.SC.; Mrs. E. E. L. Dubois, M.R.S.T.; Henry Gregor Ellice; George Aubrey Felton; John P. C. Goodman; A. V. J. Harvey, M.B.E.; Arthur John Heamon, B.A.; Reverend T. W. G. Hopper; George Hutchinson; Thomas John Jones; Harvey J. Klemmer; Reverend Wilfred L. Lane; Captain Francis Leeson; Ernest J. G. Long; Captain Ian MacRobert; Gilbert L. Marson, M.A.; J. V. Mills, M.A.; Richard F. More; Chima N. Oji, M.A., DIP. ED.; F. K. Ormondroyd, B.A.; John Patrick F. Reeve; Reginald T. Richardson; Frank Arthur Sclater, O.B.E., M.C., M.A., M.I.E.E.; Miss M. D. M. Sinnathamby; Arthur James Stevens; Lieut.-Colonel M. P. Tuteur; John Murchie Webb; John P. Webster.

Transferred from Associate Membership: James Edward F. Longman; Miss Nancy Drew.

Elections to Associate Membership: Owen George Birch; Anthony Victor Jell; Frederick W. Perry; Josephine E. Shipley.

Paper: French Explorations in Central Greenland. By Paul-Emile Victor

18 November 1949. A meeting of the Institute of Navigation

Paper: Navigation in high speed flight. By Wing-Commander E. W. Anderson

Published December 1949

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